THE tool AND manufacturing engineer

DECEMBER 1961

brazing

AMERICAN SOCIETY OF TOOL AND MANUFACTURING ENGINEERS

REJUVENATING RED-HEADS

How to make an old Boringhead or Wheelhead Good as New

by Arthur Walsh
Manager, Parts Sales
The Heald Machine Company

There's only *one* way to make an old Red-Head good as new. Return it to its maker!

This statement is neither facetious nor exaggerated. Let's look at the facts.

A precision machine tool spindle, although basically simple in design, is one of the most carefully engineered and meticulously manufactured components of the entire machine. This is particularly true of Heald Red-Head Boringheads and Wheelheads. It has to be that way, for on the *spindle* depends the performance of the machine and the reputation of the Company.

When a Red-Head Wheelhead or Boringhead needs reconditioning, and you want it restored to original Red-Head precision, ship it back to us here in Worcester. For nobody knows as much about a product as the company which made it. And certainly no one else has so much at stake on its performance!

When a head comes back here we give it the full Red-Head treatment. This includes as *much* or as *little* as needs to be done to make it as good as new. Any or all of the following items may be replaced or reworked, depending on their condition – body, spindle, caps, slingers, pulleys, spacers, spring cages, bearings and miscellaneous parts. Only the finest Ultra-precision bearings made to Heald specifications are used – precision matched for exactly the right internal clearances, fits and preloads.

After final inspection and reassembly, every rebuilt Red-Head is run continuously on the test jack for eight hours to check for temperature rise, noise level and vibration. A head that passes all of our inspections and tests is in every respect as good as new.

The cost depends on the amount of work done and the parts reworked or replaced. But in all cases you get a head that carries the original Heald guarantee, at far less than the cost of a new head.

Several of our customers have adopted a policy of regularly-scheduled head rebuilding on a preventive-maintenance basis. This has worked out very well, as it keeps the amount of repairs to the minimum, assures fast return of the rebuilt heads and substantially reduces rebuilding costs.

It pays to come to Heald for all your Red-Head repairs.

Anti-Friction bearings for Heald Red-Heads are carefully selected and thoroughly inspected before assembly into any Red-Head – the same rigid specifications must be met for bearings to be used in either **new** or **rebuilt** heads.

It Pays to come to Heald

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Worcester 6, Massachusetts

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THE tool AND manufacturing engineer

December 1961 Vol. 47, No. 6

How Computers Solve Planning Problems ..... *By J. E. McCombie* 55
In just four days, manufacturing engineers can learn how to apply computers to solve production-line planning problems.

Gadgets 58
Sine plate grinds compound angles . . . special gage speeds surface plate layouts . . . radial piercing punch eliminates hole distortion.

Conveyor Speeds Job Shop Brazing ..... *By D. H. Neudorfer* 61
Even when brazed assemblies are dissimilar, efficiency can be upped by conveyorizing the flow of parts and assemblies through the shop.

Rivets Hold Cost Line in Electrical Manufacturing 65
The reliability of riveted joints and the ease with which riveting can be automated make riveting a good choice for mass production.

Designed for Production 67
Serrated boring head cuts setup time . . . roller burnishing increases spindle strength . . . computer monitors and controls production line.

Principles of Cold Forming—Part 2 ..... *By Daniel B. Dallas* 72
With well-designed progressive tooling, cold forming can be fully automated and parts completely finished in the press.

Tools at Work 78
Tracer machining of hard materials . . . plastic bubble controls machine environment . . . stainless casting bored with carbides.

What You Should Know About Chemical Coolants ..... *By Felix Giordano* 82
Because of their high heat-removal rates, chemical coolants permit higher-speed machining. The coolant must be matched to the job.

High-Speed Small-Hole Drilling ..... *By R. W. Miller* 85
Adoption of numerical control for positioning and a high-speed spindle result in a great increase in multihole drilling productivity.

Pneumatic Press Feeder Increases Die Reliability ..... *By A. P. J. Soepnel* 87
A novel press feeder, developed in the Netherlands, virtually insures that stock is correctly positioned before die engagement.

Forward Extrusion of Steel (Reference Sheet) 91
Successful extrusion depends on good die design. Data given in the tables of this Reference Sheet are a good design guide.

ASTME IN ACTION—Society Progress Reported at Toronto Meeting 93

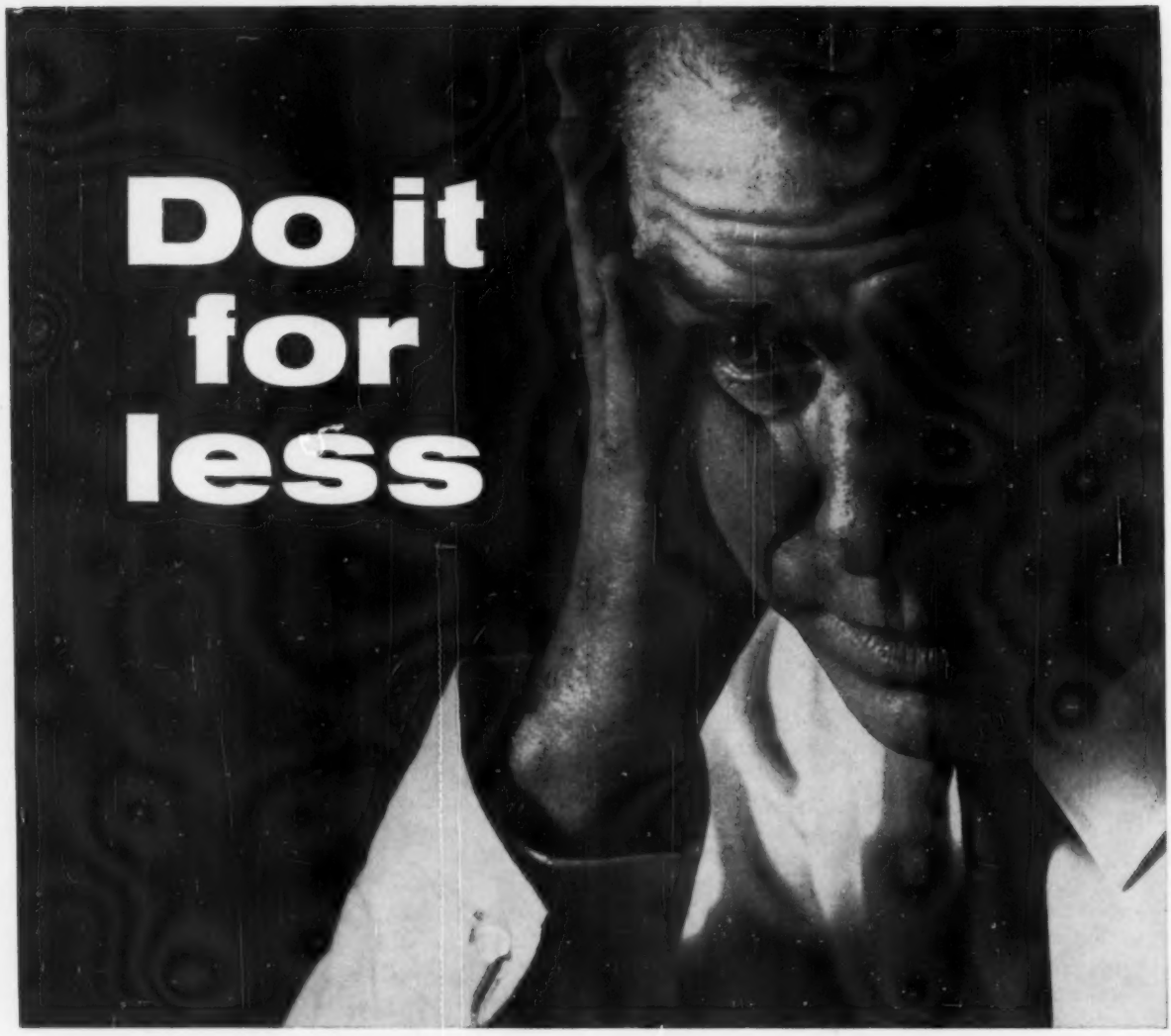
ANNUAL EDITORIAL INDEX, 1961 185

Preview of this issue 5
President's Message 53
Engineering Bookshelf 142
Field Notes 145
Letter from the Editor 3
Looking Ahead (Newsletter) 7
Men at Work 129
New Literature 125
Progress in Production 107
Readers' Viewpoints 135
Tech Digests 151
Technical Shorts 133
Tool Engineering in Europe 139
Tools of Today (New Products) 109
Who's Meeting and Where 149

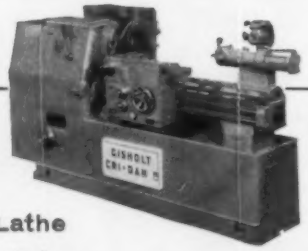
THIS MONTH'S COVER

With the advent of high temperature brazing materials, this versatile joining method is being applied for assemblies that must withstand severe service. As explained in the article starting on Page 61, it is often possible to apply a considerable degree of automation to brazing. The assembly shown here is being automatically rotated while a flame-brazing operation is being performed. Other high-efficiency brazing operations are discussed in the article.

THE TOOL AND MANUFACTURING ENGINEER is regularly indexed in the *Engineering Index Service* and *Applied Science & Technology Index*, used generally in libraries. The magazine is available in microfilm form at moderate cost.



ON A CRI-DAN AUTOMATIC THREADING LATHE



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Compressing Space

Values of time and space that have been considered standard in the past are no longer valid. It seems like yesterday that most of us believed in the sound barrier as the ultimate limit of speed for any vehicle. At or near that speed a vehicle would disintegrate into nothingness, or some other terrible fate would befall it. Now we all know better. At least we know different.

Another yesterday, many engineers considered five years the normal space of time between the conception of an idea and the commercial product embodying that idea. This included design, development, manufacture and sale. Any time short of five years was considered a miracle. Nothing short of a crash program could trim any fat from the schedule.

Some engineers still believe that same practice can continue. It, however, has passed never to return. Today, if a company is to remain successful, it must think in terms of six months or less to develop and market a product. Longer time cannot be afforded. It would be too costly. Further, with the increasing tempo of the times, the needs of the customer change. Other products can fill the bill, the customer may find an alternative or the needs may cease to exist.

To function at the pace imposed by these new conditions will necessitate the application of engineering principles to more and more operations. Tedious chores of calculating and designing will be performed by electronic "brains," leaving only higher level considerations for mental decisions. Certainly, basic tooling and processing will be determined by simulators as soon as a design is released for production.

Then, in the not-too-distant future, it is easy to anticipate that these same simulators will develop added responsibilities and prepare tapes for numerical control of machine for making the dies, jigs and fixtures as well as for operating the production machines that shape the parts and assemble the product.

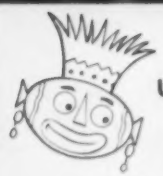
What does that leave for the manufacturing engineer? Time for creative thinking. Time needed to help keep his company in a competitive position so that its product may sell in a world market.

John W Greve

EDITOR

possibilities unlimited

for lowest cost per drilled hole!



Take a U.S. Universal Adjustable Drill Head

. . . equip it with slip spindles, and a jig-bored slip spindle plate for every production hole-pattern job you have (or want) within the capacity of the head;

. . . for each long-run, complicated or multi-piece setup, use a plain or indexing holding fixture and guide bushing plate;

. . . for short runs, merely locate the standard adjustable arm brackets quickly and accurately with a bushing plate.

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Style U-2 Head drilling housing flange. Inset shows "tool crib" of drills and slip spindle plates used with this head on 17 other setups.

U.S. Universal Heads are built in 8 models, 6 to 12 spindles, 6" to 15" drilling areas, ¼" to 1⅛" capacities. Positive drive, hardened shaved gears, super finish spindles, heavy-duty lifetime-lubricated joints.

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preview

. . . a fast look at this issue

Automatic Manufacturing Planning

Some time ago, J. E. McCombie, factory systems design engineer at General Electric Co., explained to readers of this magazine how computer simulation techniques can be applied to solve manufacturing planning problems. His article appeared in our February 1961 issue. Now he has written a follow-up article that explains, in detail, how GE is training tool and manufacturing engineers to get the most out of computer simulation. During the course of a four-day briefing, these engineers actually solve some typical manufacturing problems — solutions that are then tried out on a computer to see if they work out as planned. The computer simulates many months of production operation in a few minutes. The article starts on Page 55.

Automatic Job-Lot Brazing

When faced with the need to develop high-efficiency brazing of small lots of assemblies, Westinghouse engineers designed conveyor lines that handle dissimilar parts and enable each brazing job to be accomplished on a semiautomatic basis. Westinghouse brazing expert D. H. Neudorfer tells how the use of versatile brazing equipment and continuous-flow production lines have enabled his plant to improve both quality and efficiency. His article starts on Page 61.

Automatic Riveting

Riveting is being used extensively to assemble components of missile guidance systems, advanced electrical circuitry and modern communications equipment. As explained in the article starting on Page 65, there are several reasons why riveting is often a preferred method: the reliability of riveted joints is high and riveting lends itself to automatic assembly. Some interesting applications are illustrated in the article.

Automatic Cold Forming

Associate Editor Dan Dallas has long experience as a die designer, making his article on the design of cold forming dies authoritative and up-to-date. After discussing design principles, he shows how parts are completely formed on progressive tooling, from slug to finished part. When this kind of tooling is combined with automatic parts handling equipment, all operations can be fully automated, with cost-cutting results. See Page 72.

"Automatic" Coolants

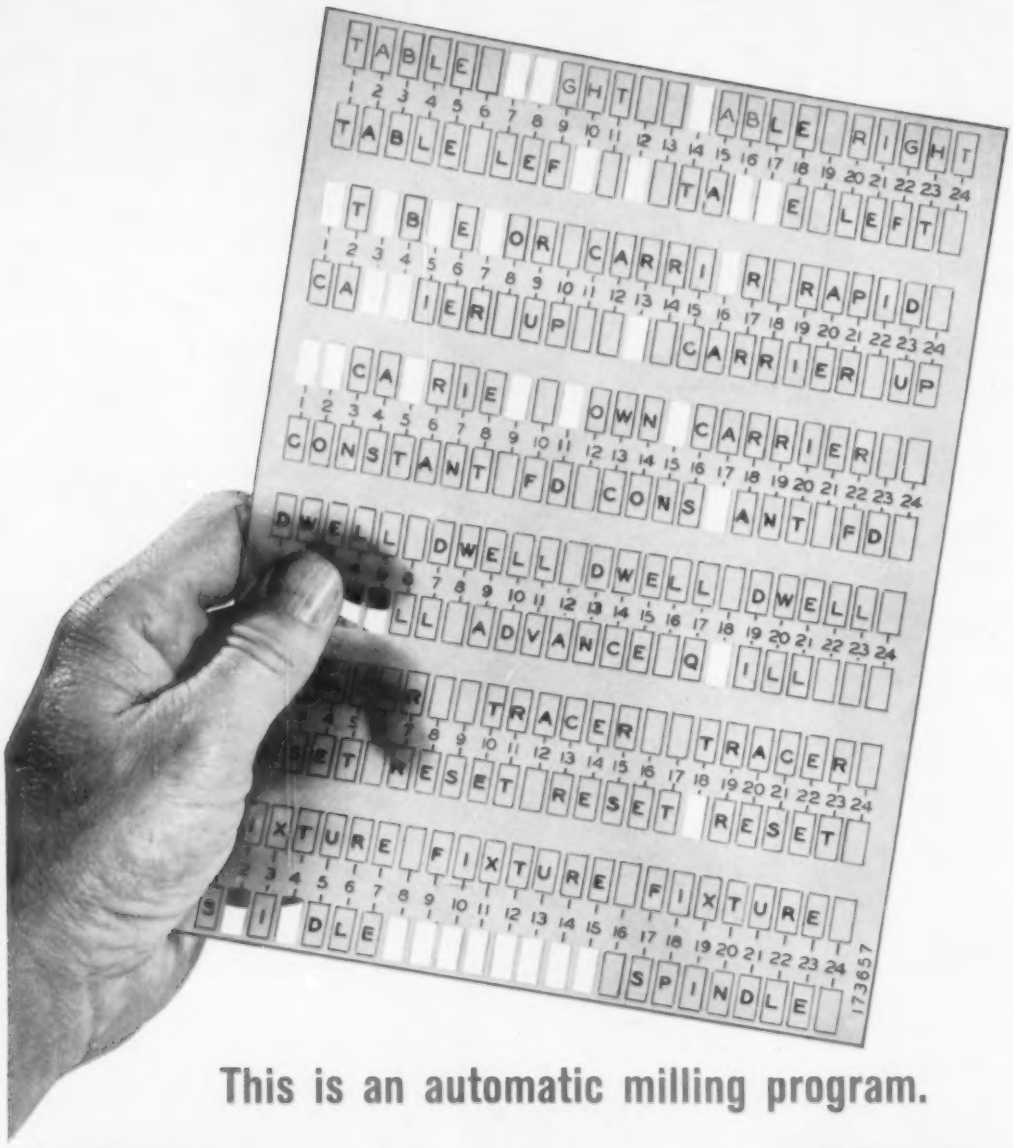
Many engineers tend to take coolants for granted. They assume that one coolant is "automatically" as good as any other. Not so, says Associate Editor Felix Giordano, who has observed and studied coolant applications for many years. His conclusion: coolants must be tailored to the job at hand. Further, there may be advantages in switching to the newer coolants. Chemical coolants, he finds, have superior heat-removal capabilities. Since heating makes cutting tools break down in service, use of chemical coolants may make possible higher cutting speeds than conventional coolants. Page 82.

Automatic Small-Hole Drilling

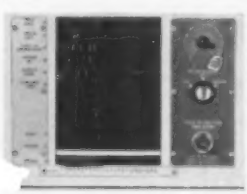
How can you increase the output of small-hole drilling operations? R. W. Miller and his colleagues at General Electric Co.'s Missile and Armament Section, had a dual solution when drilling over one thousand small holes in an aluminum plate. They added a high-speed (18,000 rpm) spindle to an existing machine and they applied tape control for positioning. Feed is controlled by the operator manually; all other operations are fully automatic. Result: a 400 percent increase in drilling efficiency. The article starts on Page 85.

Automatic Press Feeding

Use of an automatic feed mechanism is an obvious way to increase the productivity of press operations. But, says Dutch engineer A. P. J. Soepnel, if there's a possibility of misfeeding, work stoppages and die damage can result. His solution: the use of a special pneumatic press feeder that, he says, greatly improves the reliability of automatic press operations. His article, Page 87, contains photographs, drawings and diagrams that make the principles of operation of his feeder abundantly clear.



This is an automatic milling program.



Every function in an automatic milling cycle is established by this template. It fits the peg board of Telematic Control, the "brains" of CINCINNATI rise-and-fall HyPowermatics (200 Series).

The operator will simply place plugs at the positions indicated on the template, orient table and carrier trip dogs and he's ready to make parts—automatically!

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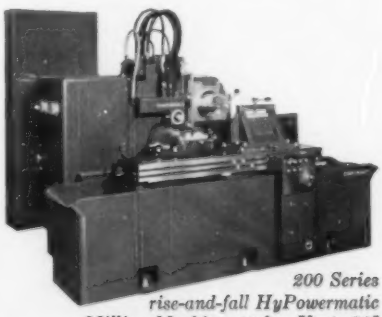

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LOOKING AHEAD

By T. W. Black
Senior Associate Editor

Westinghouse research engineers have announced the development of a new family of columbium (niobium) alloys that show greater promise than alloys of any other metal as structural materials for manned space vehicles and nuclear powered spacecraft of the future.

Compared to most refractory materials, the new alloys are light in weight, with a density about equal to stainless steel, yet they can operate in the range of 1800 to 3000 F, or about 1000 degrees higher than such steels.

High strength at high temperatures is attained without drastic loss in the workability and low-temperature ductility inherent in pure columbium. The workability is important for low-cost fabrication, and without low-temperature ductility, the intense cold of outer space would render the structure brittle and unsafe.

✓ ✓ ✓

Westinghouse has also developed a practical method for producing high-purity, high-density single crystals of tungsten. Tungsten, having the highest melting point and greatest strength of all metals, is a promising material for rocket motors.

The crystals are as large as 10 inches long and 0.22 inch in diameter, with a purity of 99.9975 percent. Small parts can be fabricated from these large crystals.

Although tungsten is usually considered to be a hard, brittle metal that is difficult to machine or fabricate, the ultrapure single crystals are actually ductile, even at temperatures as low as -330 F. Tungsten sheets that are three feet long, one-half inch wide and five mils thick have been cold-rolled from a single crystal. Wire as fine as 30 mils in diameter has been drawn.

✓ ✓ ✓

Another metal with an exotic name--tellurium--is making news because of its beneficial effects on the machinability of steel. Tellurium is a relatively rare element that is similar to selenium and sulfur in chemical and physical properties, and which resembles antimony in appearance.

A tellurium-bearing steel developed by Inland Steel Co. and cold-rolled by La Salle Steel Co. was machined 350 percent faster than the standard screw machine steel, B1112, during tests at the Cone Automatic Machine plant. The steel has a machinability potential well beyond that of any present-day bar stock. La Salle calls the new steel "LA-LED X."

✓ ✓ ✓

One of the obstacles to the use of heavy titanium plate for applications such as submarine hulls has been the inability of welding engineers to develop suitable welding methods. Battelle Memorial Institute welding experts have now produced crack-free welds in two-inch thick titanium alloy plates. Weld joint properties equal or exceed those of the base alloy.

Namco DBS Vers-O-Tool gives...
50 times more pieces per grind

...for Stevens Manufacturing Company*

When Stevens Manufacturing Company, Lexington, Ohio equipped a Brown & Sharpe No. 2 automatic with a NAMCO ⅜" DBS Vers-O-Tool, the increased threading efficiency was astonishing. On the part shown, pieces-per-grind soared from an average of 1000 to 50,000; scrappage dropped 90%; production increased by 2½ times; tolerance trouble became a thing of the past. Stevens finds such performance typical for the DBS. A non-revolving threading tool, it's designed specifically for B & S automatics; has an exclusive automatic opening and closing mechanism for unmatched precision in cutting close-to-shoulder threads. Available capacities are shown below. Thousands of manufacturers use NAMCO threading tools to slash threading costs and improve thread quality. Our 44 page bulletin DT-60 will give you all the details. Get in touch. We'll be happy to send you a copy.

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		Min. In.	Max. In.	Minus	Plus		
DBS ¼	No. OO-O-OOG-OG	.056	¼	.031	.004	⅛	18
*DBS ⅜	No. O-OG-2	⅛	⅜	.071	.012	⅛	16
†DBS ⅝	No. 2	¼	⅝	.068	.020	¼	11

*Chasers and blocks interchangeable with ⅜" DR and ⅜" DS die.
†Chasers and blocks interchangeable with ⅝" DR and ⅝" DS die.
‡And corresponding BSA sizes. Larger capacity Vers-O-Tools for B & S and BSA machines can be furnished on application.

* Aluminum expansion tube for Stevens Type H adjustable thermostat. Thread specifications: class—2; pitch—56, diameter—⅜", length—1⅝", tolerance ±.010 (actual size)

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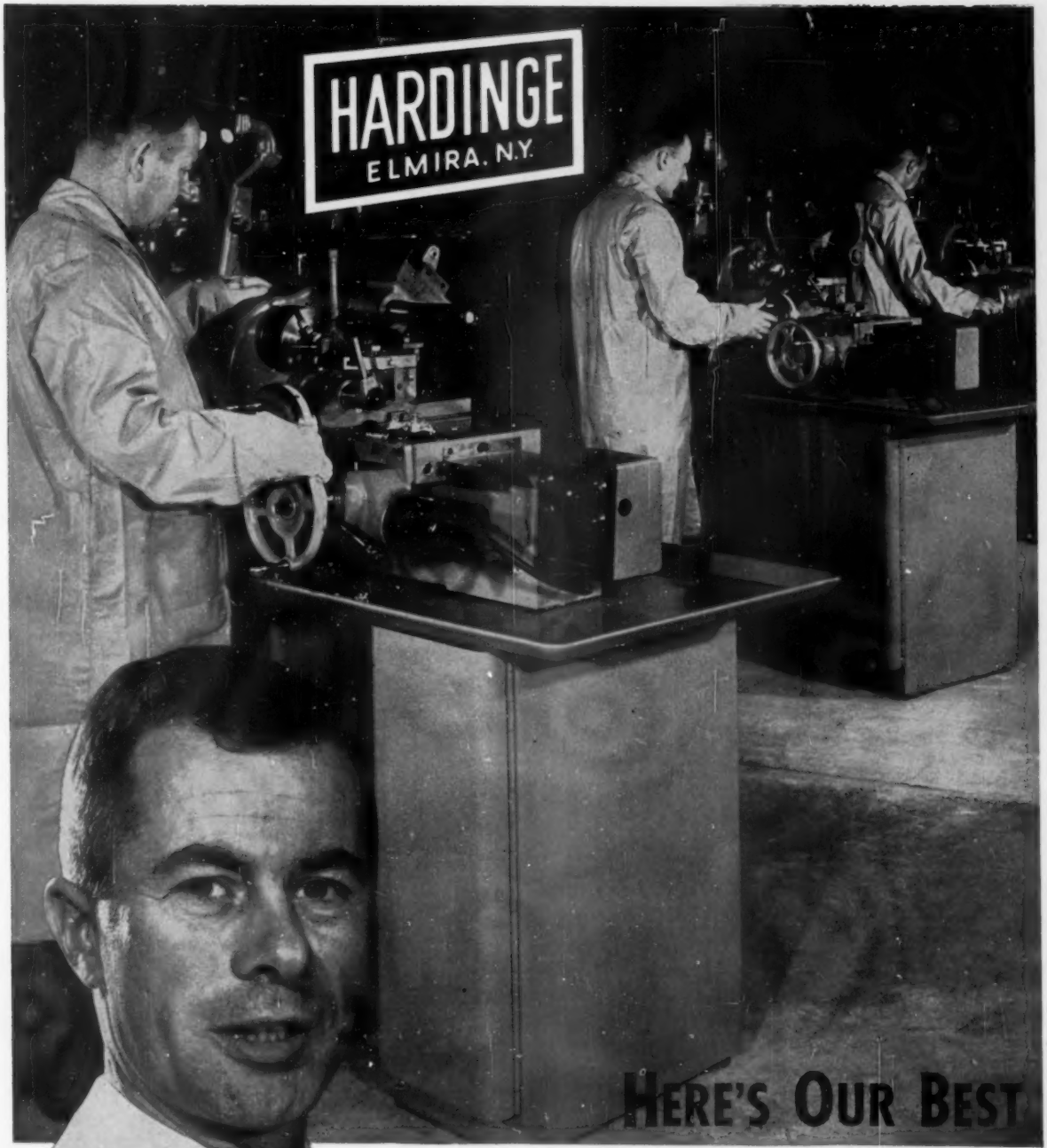

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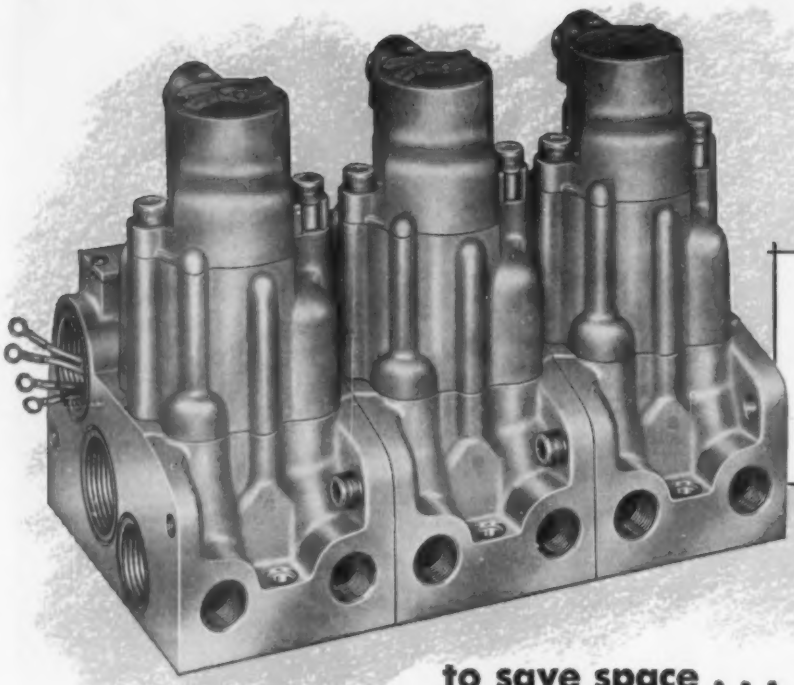

Cylinder ports side and bottom tapped, ⅜, ½ or ¾ in. NPT; through ports tapped both ends and bottom, supply—1 in. NPT, exhaust and wiring conduit ports—1¼ in. NPT; meets JIC Standards.

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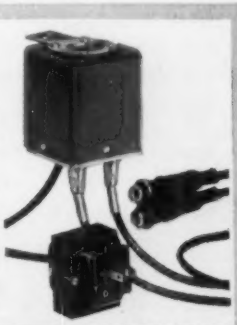

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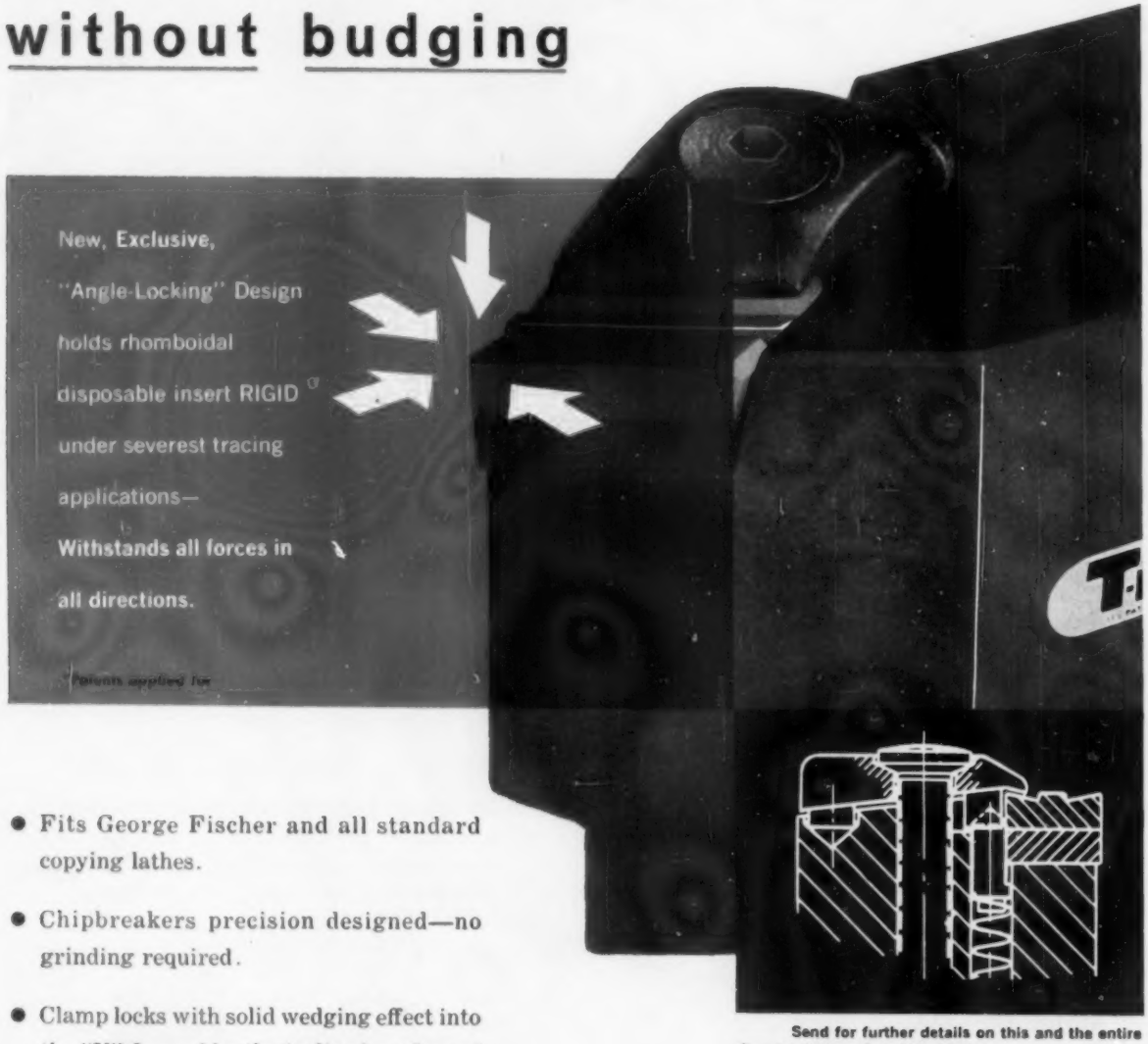

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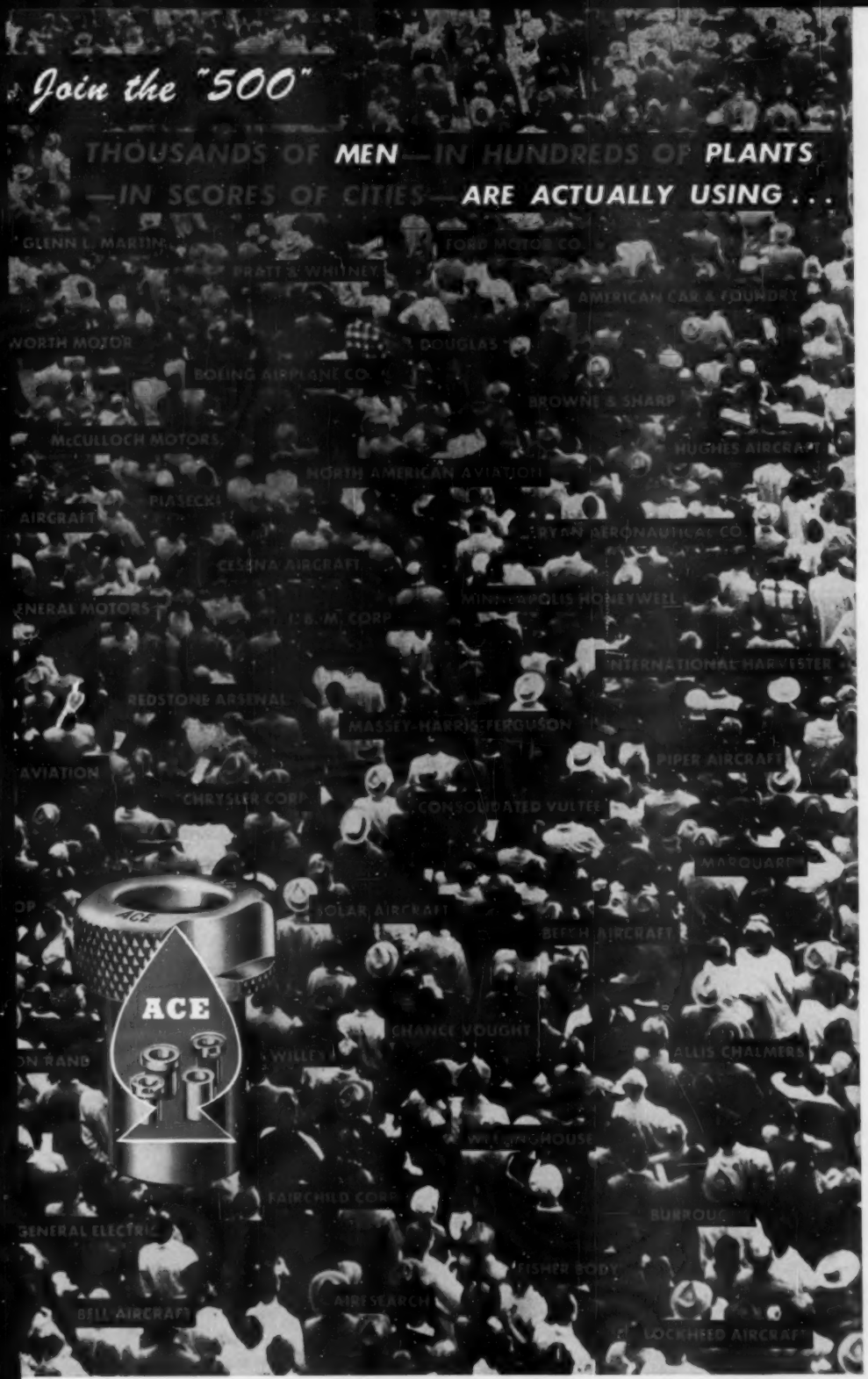

MILLIONS OF ACE DRILL BUSHINGS!

It may sound fantastic, but it's a fact! Obviously there's a reason. Could it be that ACE DRILL BUSHINGS outsell because they outwear and outperform? We believe so.

MANAGEMENT — says that extended life means reduced cost. ACE Drill Bushings are made of the finest obtainable bearing steel — to last longer and cost less.

DESIGN ENGINEERS — say the extra precision found in ACE Drill Bushings makes possible, in this day of micro-tolerances, full assurance of greater accuracy in final production.

PRODUCTION MEN — find maximum satisfaction in using ACE superior Drill Bushings. They are easy on the hands, easy on drills, and are subject to less downtime for replacement. ACE Bushings are made to do more efficiently and economically.

PURCHASING AGENTS — know a bargain when they see one. Engineers like to specify ACE, Machinists enjoy using ACE and Management appreciates the ultimate economy. What more could a careful buyer ask for?

Is it any wonder that discriminating users prefer ACE Drill Bushings?

There are many reasons why. Try 'em — you'll see!

Write for your free copy of the ACE Catalog with the all-new ACE-ASA symbols!

BE SPECIFIC — SPECIFY ACE

ACE DRILL BUSHINGS

NEW JERSEY
611 McCarter Highway
NEWARK 2 Mitchell 2-3006

ACE

HOME OFFICE
CALIFORNIA
5407 Fountain Ave.
LOS ANGELES 29 HO 9-8253

ACE

MICHIGAN
10620 West Nine Mile Road
DETROIT 37 Lincoln 8-0777

Cut your costs with QUALITY TOOLS

CLEVELAND *Quality* Tools are designed and manufactured to

- Cut faster
- Produce more parts per grind
- Reduce costly down-time

Moreover, CLEVELAND *Quality* Tools give you the added benefits of "Teamwork Tooling", whereby the talents of many people are combined to assist in reducing your costs. "Teamwork Tooling" includes not only our engineering skills and modern manufacturing facilities, but also the capable services of our Suppliers, Stockrooms, Service Representatives and Distributors.

THE CLEVELAND TWIST DRILL CO.
Cleveland 1, Ohio

QUALITY CUTTING TOOLS • BEST SERVICE THROUGH YOUR LOCAL DISTRIBUTOR

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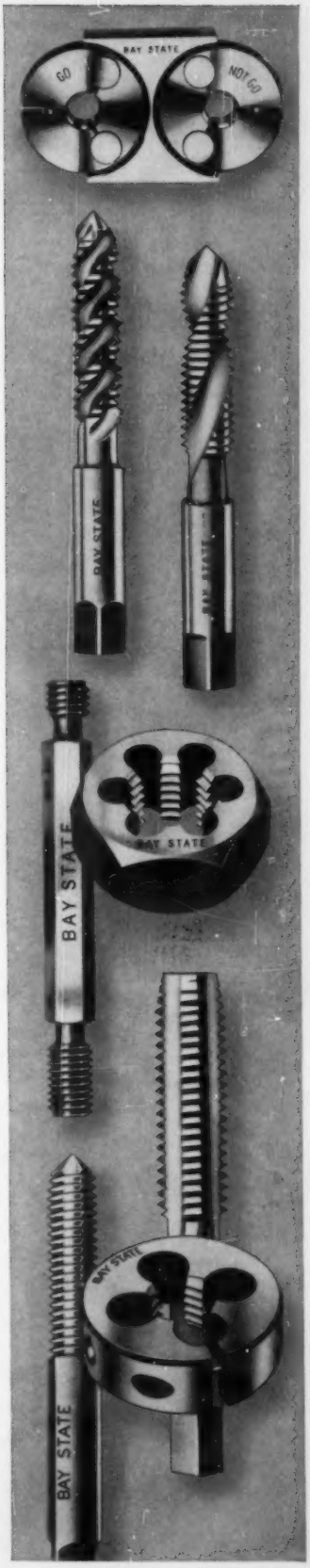
Buy tools on PERFORMANCE and SERVICE ...not on price alone

Strictly on their *superior performance*, BAY STATE Taps, Dies and Gages can help you reduce your costs.

Tools bought on price alone cannot be relied upon for dependability and long wear life. Too often they are the cause of costly down-time and excessive scrap.

You get prompt *service*, too, on BAY STATE Taps, Dies and Gages from your local Industrial Supply Distributor, *plus* our trained Service Representatives operating out of strategically located Stockrooms to help you solve your thread cutting and gaging problems.



BAY STATE TAP AND DIE CO.
Mansfield, Mass.
Subsidiary of The Cleveland Twist Drill Co.

QUALITY CUTTING TOOLS • BEST SERVICE THROUGH YOUR LOCAL DISTRIBUTOR

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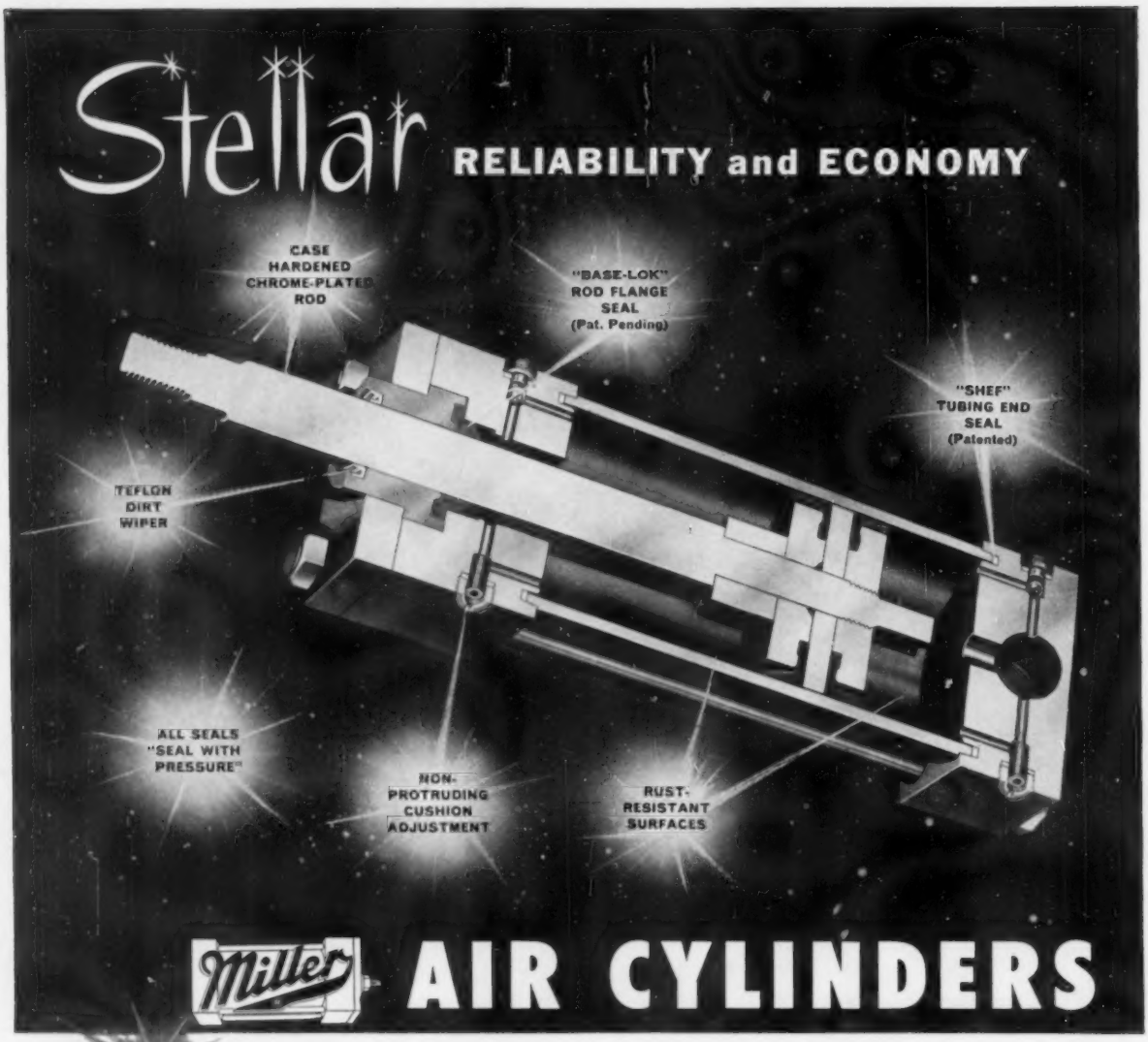
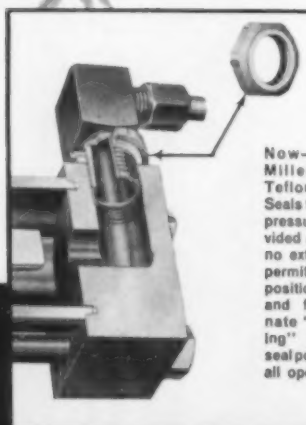
Stellar RELIABILITY and ECONOMY


CASE HARDENED CHROME-PLATED ROD
"BASE-LOK" ROD FLANGE SEAL (Pat. Pending)
"SHEF" TUBING END SEAL (Patented)
TEFLON DIRT WIPER
ALL SEALS "SEAL WITH PRESSURE"
NON-PROTRUDING CUSHION ADJUSTMENT
RUST-RESISTANT SURFACES

Miller AIR CYLINDERS

PORT SEALS



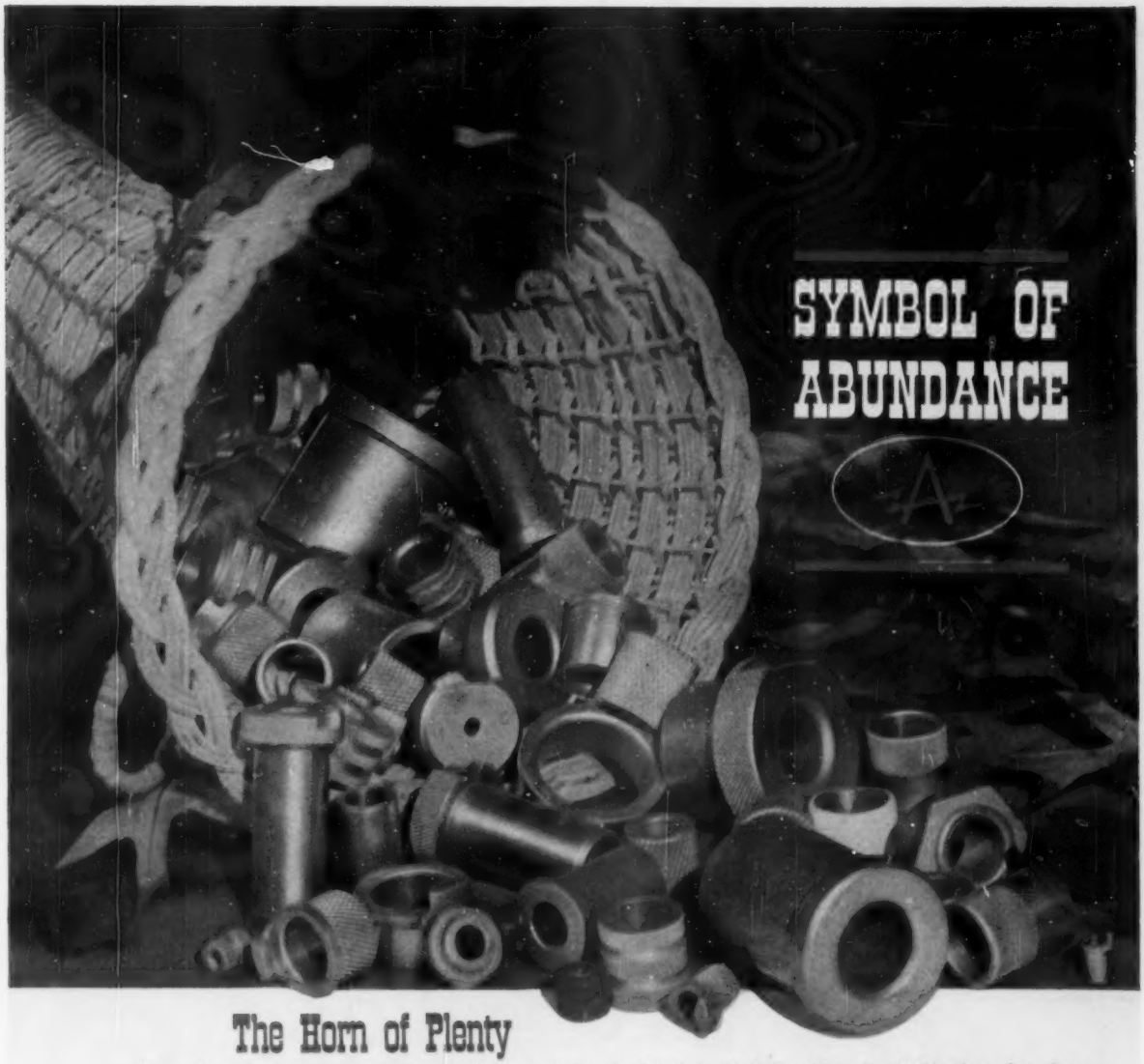
Now—with every Miller Cylinder—Teflon-sealed Port Seals that "Seal with pressure" are provided as standard at no extra cost. They permit much faster positioning of lines and fittings, eliminate "overtightening" damage, and seal perfectly against all operating media.

Here are eight more reasons why Miller Air Cylinders continue to be the most economical and reliable cylinders that money can buy. These stellar features—including the new port seals—are standard Miller construction—yours at no extra cost. Thus, they provide appreciable savings in original investment—*particularly for those who insist on "J. I. C." quality throughout.* Savings in operating costs are even greater, because these features are proven assurance of longer cylinder life, greater efficiency, reduced maintenance and downtime.

Specify "Miller" for greater reliability and economy! Write for bulletin.

R

MILLER FLUID POWER
DIVISION OF FLICK-REEDY CORPORATION
7N019 York Road, Bensenville, Illinois
AIR AND HYDRAULIC CYLINDERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS • BOOSTERS



The Horn of Plenty

The wheat is gathered, the harvest is in and the yield is bountiful. Traditionally at this time, Americans pause in gratitude to reflect upon the richness this land of ours has bestowed—in both material wealth and wealth of opportunity.

We at American are truly thankful for what we have attained—in 20 short years, from a small and little known company to the enviable position of the world's largest manufacturer of drill jig bushings, with 36,000 standard sizes in stock.

Only in America—the Land of Plenty—could this American success story happen—and only with the support of American business.

American gives thanks—humbly and sincerely—to the 200,000 loyal customers whose consistent purchases of our products have made the American dream come true. May we continue to serve you long and well.

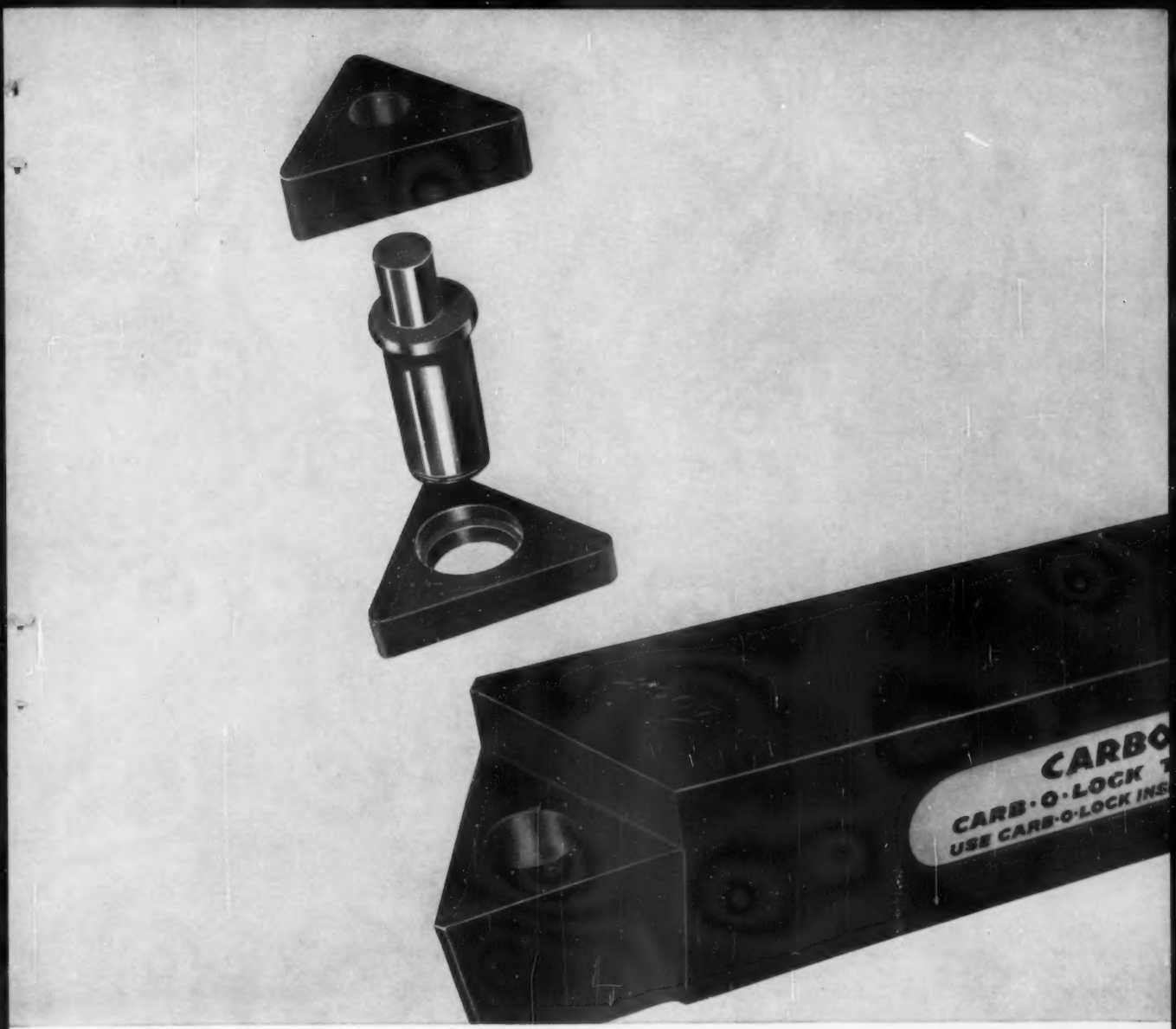
American DRILL BUSHING CO. / 5107 PACIFIC BLVD. / LOS ANGELES 58, CALIFORNIA

TELEPHONE LUdlow 3-1122 / TWX 1315 / FAX LOS ANGELES

A. S. A. and American Standard Sizes

BUSHINGS FOR PLASTIC TOOLING

How to cut your disposable-tooling costs by 30 per cent at no sacrifice in quality or output. (Answer is on the next page.)



With the new Carb-O-Lock toolholder-insert combination. The single most important advance in the whole history of metal-cutting.

Save 30 per cent when you buy it. Save 40 per cent when you use it.

These are minimums. Users of the Carboloy Carb-O-Lock toolholder-insert combination have reported savings many times higher. Why?

Simple. The Carb-O-Lock design is simple. Using a cam-action locking principle, the Carb-O-Lock has just three parts (not including insert). Insert changing and indexing is a breeze; parts inventories can be held to absolute minimums. Streamlined design lets you bring the toolholder closer to your work. And less overhang means less vibration, less insert chipping and breaking.

Plus: the Carb-O-Lock gives you proven performance. A major diesel engine manufacturer discovered Carb-O-Lock allowed nearly triple the feed, eliminating two machines. A locomotive and car equipment company found Carb-O-Lock's simple, rugged design reduced time for tool changes and permitted maximum horsepower utilization.*

Carb-O-Lock inserts are available now in Grade 883 for machining cast iron, as well as many operations on the following materials: high-temperature alloys, type 300 stainless steel, brass, bronze.

So start your savings program today. Phone your Authorized Carboloy Distributor and order your Carb-O-Lock toolholder-insert combination. Save 30 per cent. And more.

Metallurgical Products Department of General Electric Company, 11101, E. 8 Mile Street, Detroit 32, Michigan.

**Case histories available on request*

CARBOLOY
CEMENTED CARBIDES

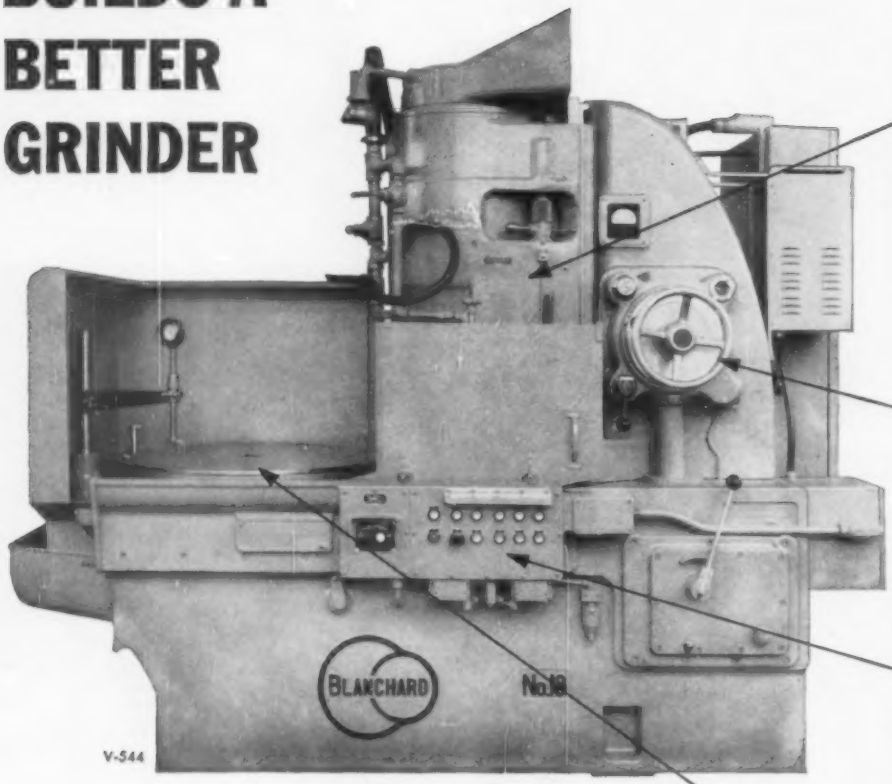
METALLURGICAL PRODUCTS DEPARTMENT

GENERAL ELECTRIC

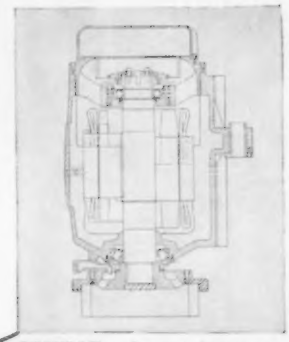
CARBOLOY CEMENTED CARBIDE BLANKS AND DISPOSABLE INSERTS • BRAZED TOOLS • TOOLHOLDERS • CARBIDE DIES • WEAR PARTS

Use Reader Service Card, CIRCLE 19

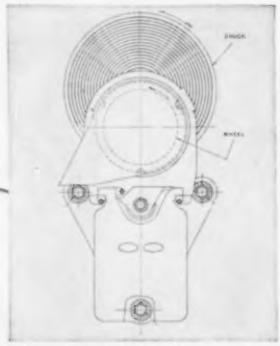
HOW BLANCHARD BUILDS A BETTER GRINDER



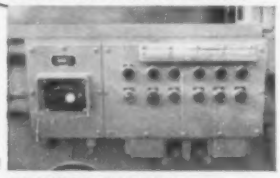
V-544



SPINDLE . . . incorporates a superior, pre-loaded anti-friction bearing system that removes all backlash and radial play. Integral "balanced" mounting of rotor on spindle eliminates vibration.



WHEEL HEAD COLUMN . . . is of heavy box-section design for extra rigidity . . . supported at 3 widely-spaced points. Column may be easily adjusted for alignment. Special column tilting devices available to produce concave or convex surfaces.



V-541

GRINDER CONTROL . . . is compact and conveniently located for fatigue-free handling. All control panels are BLANCHARD manufactured for troublefree operation.

W-949

MAGNETIC CHUCK . . . provides maximum useful magnetic surface . . . has such closely spaced poles, that work as small as a quarter will always touch two or more.

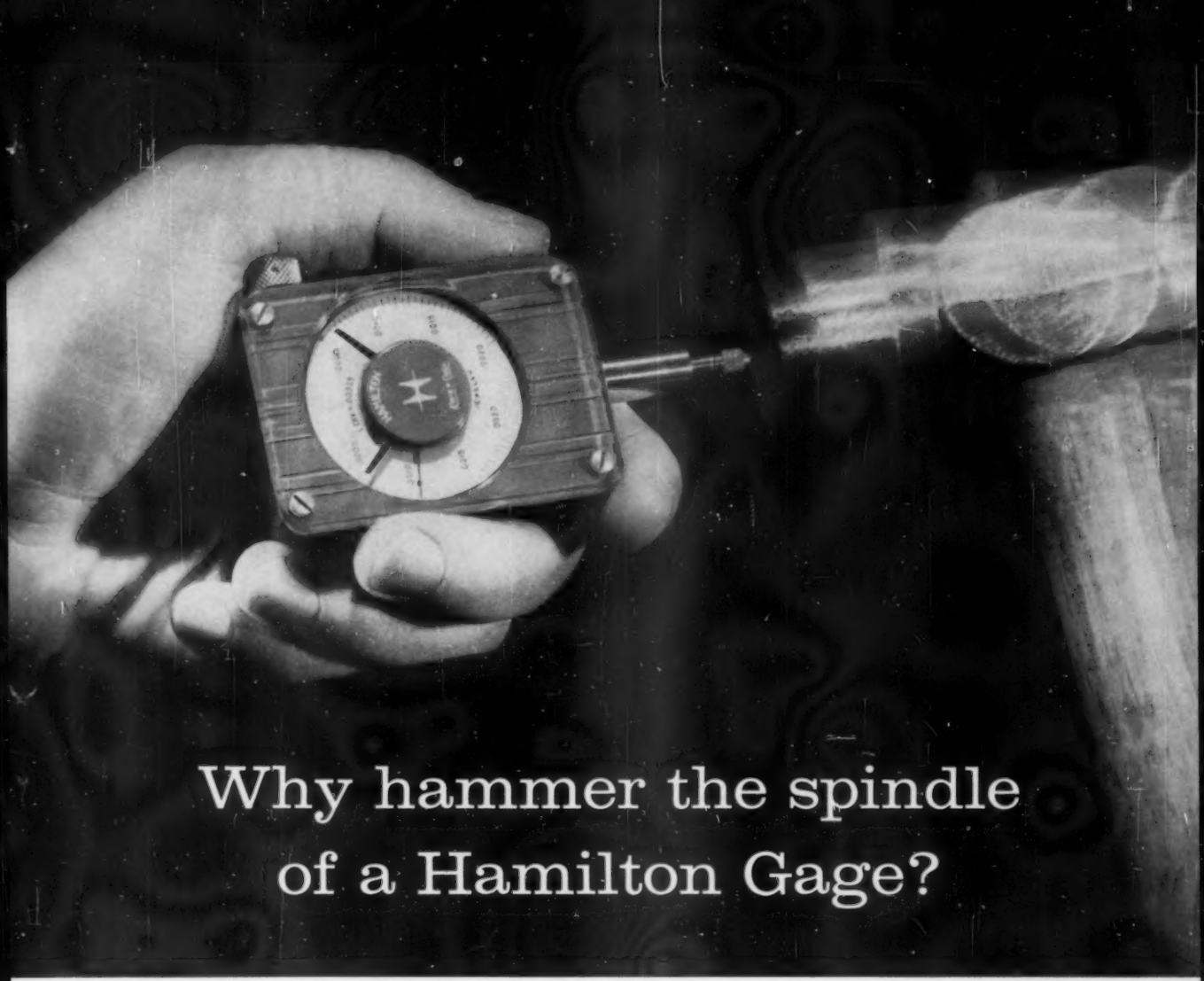
There's no mystery about the *better* performance you get with a BLANCHARD Surface Grinder. It's simply a matter of *better* design of each individual machine part. For example, look at just 4 features of the No. 18, shown at the right.

Get complete details on all 24 models of BLANCHARD grinders. They're today's leading high precision, high production grinders on materials ranging from carbon to quartz . . . from bronze to steel. You can handle parts ranging from tiny jewels to giant plates up to 108″ across corners.

PUT IT ON THE BLANCHARD **THE BLANCHARD MACHINE COMPANY**
64 State Street, Cambridge 39, Massachusetts

Use Reader Service Card, CIRCLE 20

Use Reader Service Card, CIRCLE 21



Why hammer the spindle of a Hamilton Gage?

To prove that Hamilton Gages are built to take it. (You can drop a Hamilton Gage on its spindle and it still maintains its accuracy.) The reason: a unique, indirect transmission action from spindle to gear mechanism. Pressure at the spindle end *releases* the movement for operation rather than driving it. As a result, any shock at this point cannot force the gear mechanism . . . and *you* cut replacement costs.

More reasons why you can depend on Hamilton Gages? Hamilton's offer of a complete movement replacement for a nominal charge. Hamilton's gage repeatability to .00001". Hamilton's light gaging force (2 or 4 ounce) that's adjustable. Hamilton's years of watchmaking experience, so valuable in maintaining the fine accuracy of precision gages. Hamilton's complete line of mechanical and electric gages for post-process inspection or in-process production control.

For free data sheets on Hamilton Gages, write to **Dept. 2112,** Hamilton Watch Co., Lancaster, Pa. They give full specifications on most items in our line. Or, if you have a special gaging problem, write directly to E. P. Barber, Director of Industrial Products Division.

Kwik-Chek Gages—another precision product of the

HAMILTON WATCH COMPANY

Industrial Products Division, Lancaster, Penna.

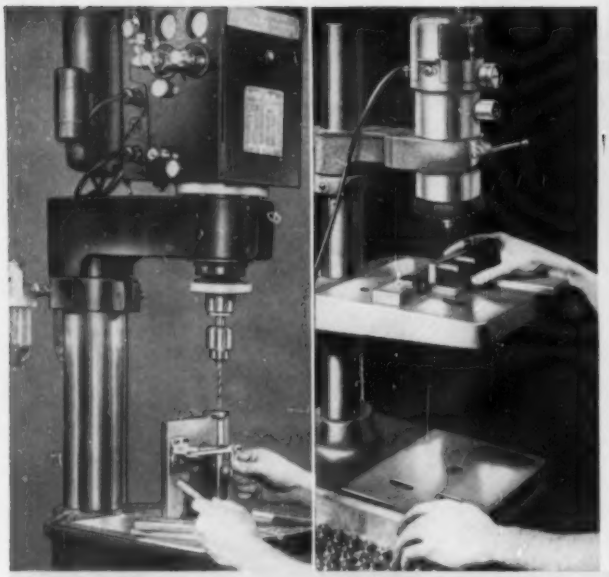
HAMILTON RECESS DEPTH GAGE for production gaging of recesses. Comes with both tiltable and rigid table for easiest location of parts.

HAMILTON HOLE GAGES replace as many as 700 plug gages. Precision accuracy in range from .025" to .380" . . . increments of .001".

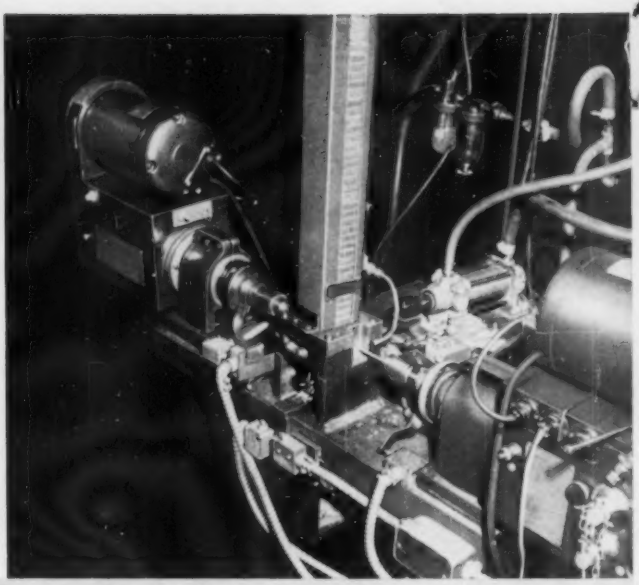
HAMILTON ELECTRIC GAGING SYSTEMS for in-process control. Lights indicate several out-of-tolerance dimensions simultaneously.

HAMILTON HORIZONTAL INDICATING MICROMETER GAGE for absolute measurements. Accurate to .00005" over entire range.

HAMILTON PRECISION DIAL COMPARATOR for applications requiring ultimate in precision. Fine adjustment assures perpendicularity.



general purpose machining
Use any Dumore Drilling Tool for a continuous job...tapping, drilling, etc....in one set-up.



automated set-up
Combine one or several Dumore Drilling Tools with automatic workpiece feeding and holding devices for specific operations.

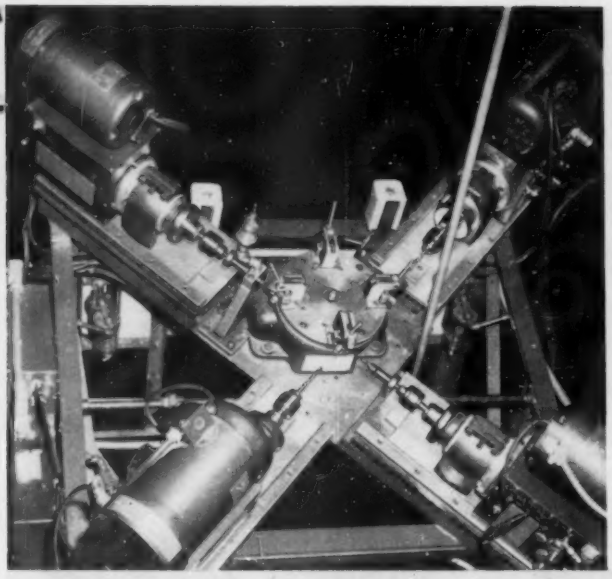
UNLIMITED MACHINING VERSATILITY

for holes from .001 to 3/8"

...1/2" TAPPING

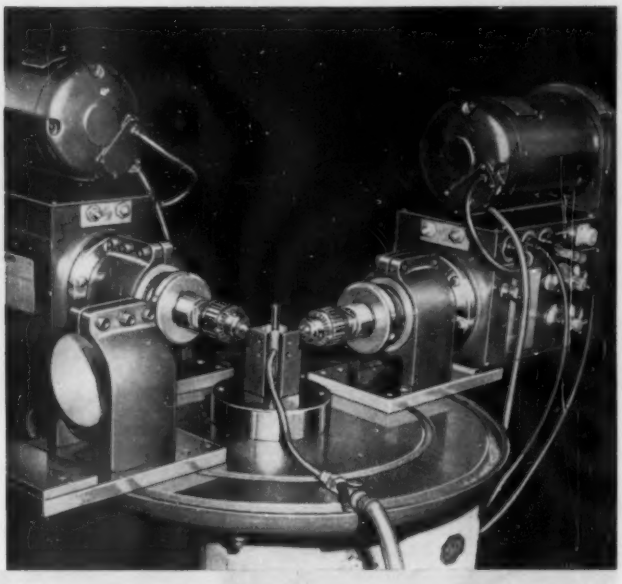
You can tap, drill, ream, chamfer, spotface, center, deburr and do related work in general purpose, automated set-up, multiple machining and changing set-ups...at lower cost.

YOUR DUMORE DISTRIBUTOR HAS COMPLETE STOCKS FOR FAST DELIVERY



multiple machining

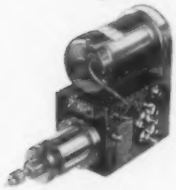
Combine several Dumore Drilling Tools in one set-up to perform several different operations, at the same time or in sequence.



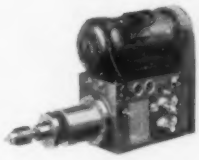
changing set-ups

Move the same Dumore Drilling Tool to several different set-ups to do specific jobs.

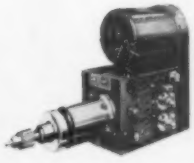
DUMORE® PORTABLE, PRECISION DRILLING and TAPPING TOOLS



"hi-speed" units
800 to 15,000 rpm speeds for holes from .020" to 1/4", 2 models. From **$665***



"drill-n-tap" units
Drills or taps automatically at the flip of a switch. Drilling No. 60 to 3/8", tapping 0-80 to 1/2-13. (in mild steel). From **$907.50***



drill units
Automatic drilling units. Built-in power and controls. 2 models. Drills No. 60 to 3/8" (in mild steel). From **$595***

drill heads
No. 80 to 5/32" drill capacity—built-in power for automatic operation. 2 models. From **$237.50***

micro-drill
Drills small holes from .001" without special operators. A miniature jig borer. **$625***

sensitive drill press
No. 80 to 1/8" drill capacity. Foot switch operation. **$102.50***

*FOB Racine

drill speeder
Converts standard drill press or lathe to high speed driller. Fits into chuck, supplies its own power. No. 80 to 1/8" capacity. **$47.50***

and Dumore engineered production tools and accessories including complete automatic drill presses and fixtures.

YOU CAN DO MORE WITH

DUMORE® PORTABLE PRECISION METALWORKING TOOLS

THE DUMORE COMPANY
1310 Seventeenth Street, Racine, Wisconsin

HI-SPEED DRILL UNITS • DRILL-N-TAP UNITS • DRILL UNITS • DRILL HEADS • MICRO-DRILLS • DRILL GRINDERS • TOOL POST GRINDERS • HAND GRINDERS • FLEX-SHAFT TOOLS • QUILLS AND ACCESSORIES • VERSA-MIL UNITS

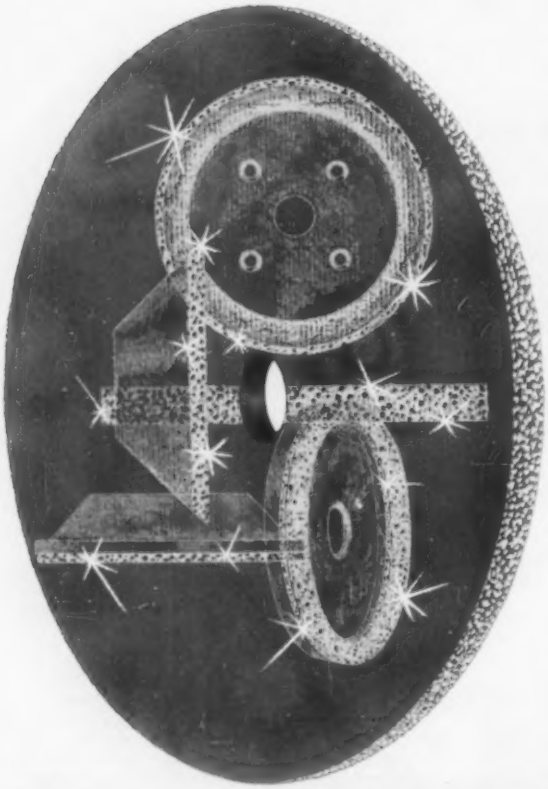
When you have a need for erector-type components for special machines... machining heads, feed tables, machine beds... contact our subsidiary Master Manufacturing Company, Hutchinson, Kansas.

SEE HIM FOR A DEMONSTRATION...OR WRITE FOR BULLETIN D-60-C

Three types of natural diamonds provide the broadest range of grinding requirements

There are 3 distinctive classifications of natural diamond abrasive, as defined below, which are based principally on differences of shape and strength of the diamond particle selected to meet specifications for resinoid and metal bonds. Each of these types evidences individual characteristics that demonstrate optimum grinding efficiency in certain specific applications. This extended range of characteristics is an exclusive feature of natural diamond that is contributing effectively to wheel performance by meeting the precise requirements of various job conditions.

In modern development and design of peripheral and flaring cup wheels, the choice of natural diamond type is considered equally with other elements such as grit size, rate of feed, surface and table speeds, to maximize efficiency in given applications. Knowledge of the effect of correct diamond type selection on grinding efficiency is another result of Engelhard Hanovia research in diamond technology. * * * * * * * * * * * * * * * *

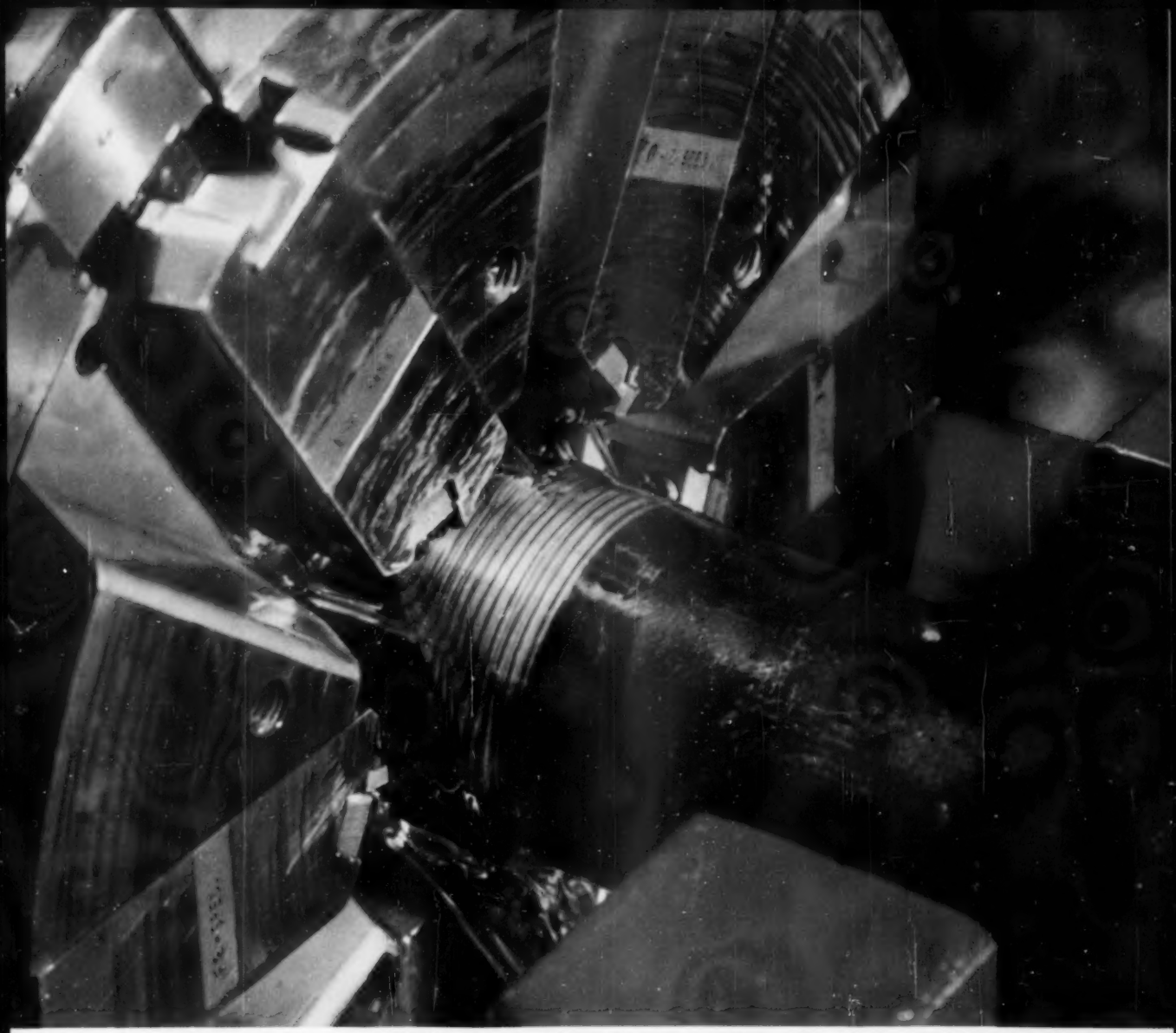


SND-RB (Selected Natural Diamond for Resinoid-Bond Wheels) is the result of advanced methods of scientific shape selection, whereby only needle and sliver shaped particles are selected for maximum grinding efficiency at lowest possible cost. SND-RB is greatly superior in the majority of applications requiring resin bond wheels. It is available in Treated and Untreated form for specific job applications. SND-RB Treated is subjected to a heat treating process which results in the formation of a film of graphic carbon on the diamond surface. Because graphite is considerably more reactive chemically than diamond, and more easily wet, it is indicated that the surface film greatly improves adhesion between the resin bond and the diamond. Under certain shop-use conditions, however, SND-RB Untreated has been found to be the optimum grit for maximum grinding efficiency.

SND-MB (Selected Natural Diamond for Metal-Bond Wheels) is carefully selected blocky-shaped diamond material. The internal structural strength and blocky shape of this natural diamond make it extremely resistant to breakage. This quality is being utilized to excellent advantage in metal bond wheels.

CONVENTIONAL NATURAL DIAMOND possesses the excellent abrasive efficiency of all mined diamonds. It contains a variety of shapes which provide special advantages in certain grinding applications.

★ENGELHARD HANOVIA, INC.★
INDUSTRIAL DIAMOND DIVISION
113 ASTOR STREET • NEWARK 2, NEW JERSEY



This is just one of the many applications of Sunicut 85, which is one of a whole series of Sunicuts . . . all transparent.

SUNICUT 85 is a heavy-duty cutting oil that lets you see what you're doing

Transparent, fast-draining Sunicut® 85 leaves the workpiece clear for inspection as you go.

Especially designed for use on high-alloy steels, Sunicut 85 is ideal for heavy-duty work on automatic screw machines and production form grinders. It's a natural for pipe threading and similar heavy-duty operations requiring frequent and close inspection.

Easy pumping, fast metal-wetting, and excellent extreme-pressure lubrication are other advantages of Sunicut that lead to production economy for you.

Ask your Sunoco representative about saving money with Sunicut, or write to Dept. I-10.

Industrial Products Department

SUN OIL COMPANY, Phila. 3, Pa.

SUNOCO

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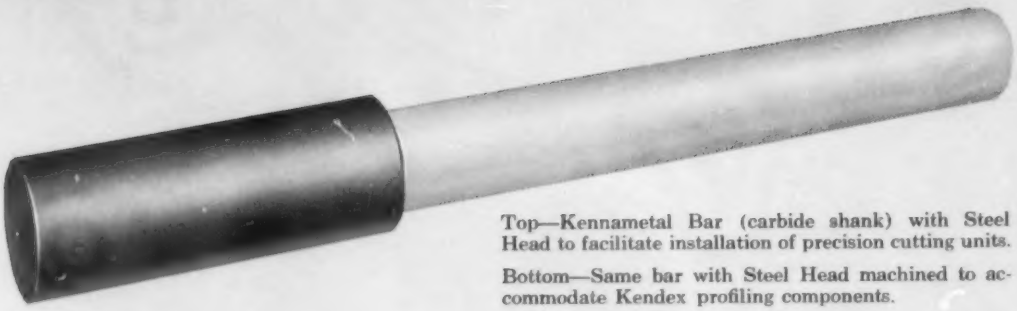
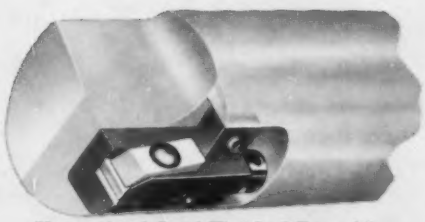
In Canada: Sun Oil Company Limited, Toronto and Montreal.



Top—Kennametal Bar (carbide shank) with Steel Head to facilitate installation of precision cutting units.

Bottom—Same bar with Steel Head machined to accommodate Kendex profiling components.

Kennametal Semi-Finished K-Bar converted to accommodate adjustable boring head.



Kennametal Semi-Finished Bar with Kendex Adjustable Unit installed.

NOW KENDEX* K-BARS WITH STEEL HEADS FOR MAKING "SPECIALS" FAST

10 STOCKED SIZES FOR MANY APPLICATIONS

This new line of Kennametal* bars, attached to machinable steel heads, speeds the making of special tooling to produce straighter holes and better surface finishes on precision boring jobs.

With these bars you get all of the advantages of Kendex K-Bars with shanks of rigid Kennametal, plus speedy adaptability to meet requirements of a wide range of boring operations. The rigid Kennametal shank (94,000,000 psi vs. 30,000,000 for hardened steel) minimizes deflection and reduces chatter by damping vibration. K-Bars permit greater length-to-diameter ratios to be used, and feeds and speeds to be increased. Closer tolerances can be maintained. Extra boring and grinding operations are often eliminated to further reduce unit costs.

The steel heads (28-32 Rockwell C) can be machined for various types of cutting inserts—such as Kendex adjustable units or other types of precision cutting mechanisms. The steel heads provide a generous amount of stock to provide for any tooling normally required on a particular bar diameter.

Ten sizes of semi-finished K-Bars are available from stock. Bar diameters range from $\frac{7}{16}$" to $2\frac{1}{2}$" . . . steel head diameters from $\frac{3}{4}$" to $4\frac{5}{8}$". Bars range in length from $7\frac{5}{8}$" to $28\frac{1}{4}$". Bars with shank diameters of $\frac{3}{4}$" and larger have a coolant hole through the center.

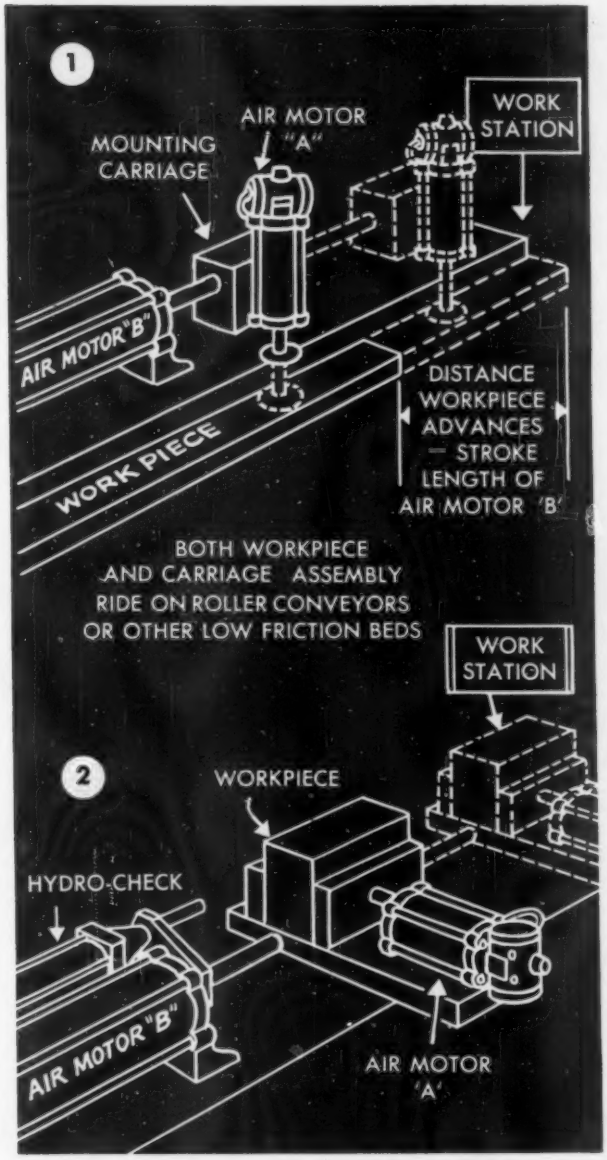
For complete information, call your Kennametal Carbide Engineer. He has a desk demonstrator that lets you *feel the difference* in the rigidity of Kennametal and steel. And he can show you samples of surface finishes produced by K-Bars and steel bars, under identical conditions, that demonstrate the value of Kennametal's high rigidity. KENNAMETAL INC., Latrobe, Pa.

*Trademark

35808

INDUSTRY AND KENNAMETAL ...Partners in Progress

TWO IDEAS YOU CAN USE TO FEED AND POSITION WORK AUTOMATICALLY



In most plants today, there are few operations which present greater cost-cutting opportunities than the feeding and positioning of workpieces. Yet often this potential saving remains untapped because the high cost of special workfeeding and positioning equipment may not appear justified.

However, using Bellows Air Motors®, fast, accurate, trouble-free devices to "spot-automate" such operations can be built in your own plant—by your own men—for a fraction of the cost normally involved in such equipment. These two devices are typical:

Fig. 1, at left, shows a set-up used frequently to feed steel bar stock to a cut-off saw, to feed strip metal to a punch press, to position a strip of wood for drilling holes at regular intervals along its length, and in other applications where it is desired to alternately advance a workpiece and pause while an operation is performed. By proper positioning of work stations, it is possible to perform a sequence of operations, such as drill-and-tap, or punch , form-and-stencil.

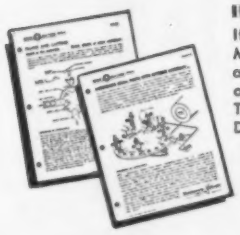
After the piston rod of Air Motor "A" has advanced to hold the workpiece, the piston rod of Air Motor "B" advances, moving carriage, Air Motor "A" and workpiece a predetermined distance forward. Workfeeder pauses while the operation is performed. Then, Air Motors retract —and the sequence is repeated.

Variations of the extremely simple set-up shown in Fig. 2 are used in virtually every industry. With the piston rod of Bellows Air Motor "A" advanced to clamp the work, Air Motor "B" advances the workpiece to the work station, pauses during the operation, then retracts. Operator unloads, reloads, and the sequence repeats. Incorporation of a Bellows Hydro-Check® provides a perfectly controlled, highly accurate feed rate, permitting this set-up's use with routers, drills, milling machines and similar equipment.

* * * *

In addition to The Bellows Air Motor, used as the "heart" of work feeding and positioning devices designed and built by creative production management everywhere, Bellows-Valvair also produces a line of Rotary and Linear Feed Tables, as well as a series of Rotary Index Tables—all completely integrated pneumatic "packaged" units including all controls and built-in wiring.

851-C



INTERESTED IN CUTTING WORKFEEDING COSTS?

If so, you'll want the special "package" we've made up. It includes a "Spot-A-Mation Idea" File, containing information on a number of different workfeeders, as well as complete information enabling you to "spot-automate" scores of other operations. In addition, we've included specs on our Rotary Feed and Index Tables and Shuttle Work Feeders. For yours—without cost or obligation—address: Dept. TE-1261, Bellows-Valvair, Akron 9, Ohio.

Bellows-Valvair

Division of IBEC AKRON 9, OHIO

These names assure you the best in pneumatic, hydraulic and electronic components

BELLOWS • VALVAIR • SINCLAIR-COLLINS • HUNT • HYQUIP • JACKSON ELECTRONICS

HEADQUARTERS

for quality gun drilling tools!

THE *Star* GUN DRILL

THE *Starbore* MULTIPLE FLUTE REAMER U.S. PAT. NO. RE24769

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THE *Starbore* MULTIPLE-DIAMETER REAMER U.S. PAT. NO. RE24769

Star offers a complete line of precision gun drilling tools. There is a size and type specially engineered for every production, material or finish requirement. Every tool in the line is precision built of the best possible materials.

Every tool has been thoroughly tested for efficiency and service life, both in our own research and development laboratories and in metal-working plants throughout the country.

When you buy Star Gun Drilling Tools you buy proven quality and efficiency.

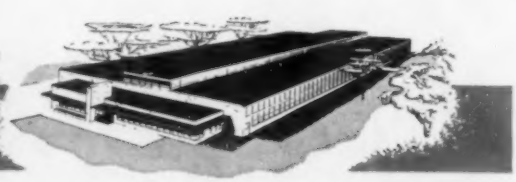
Write for complete catalog of Starbore Gun Drilling Tools

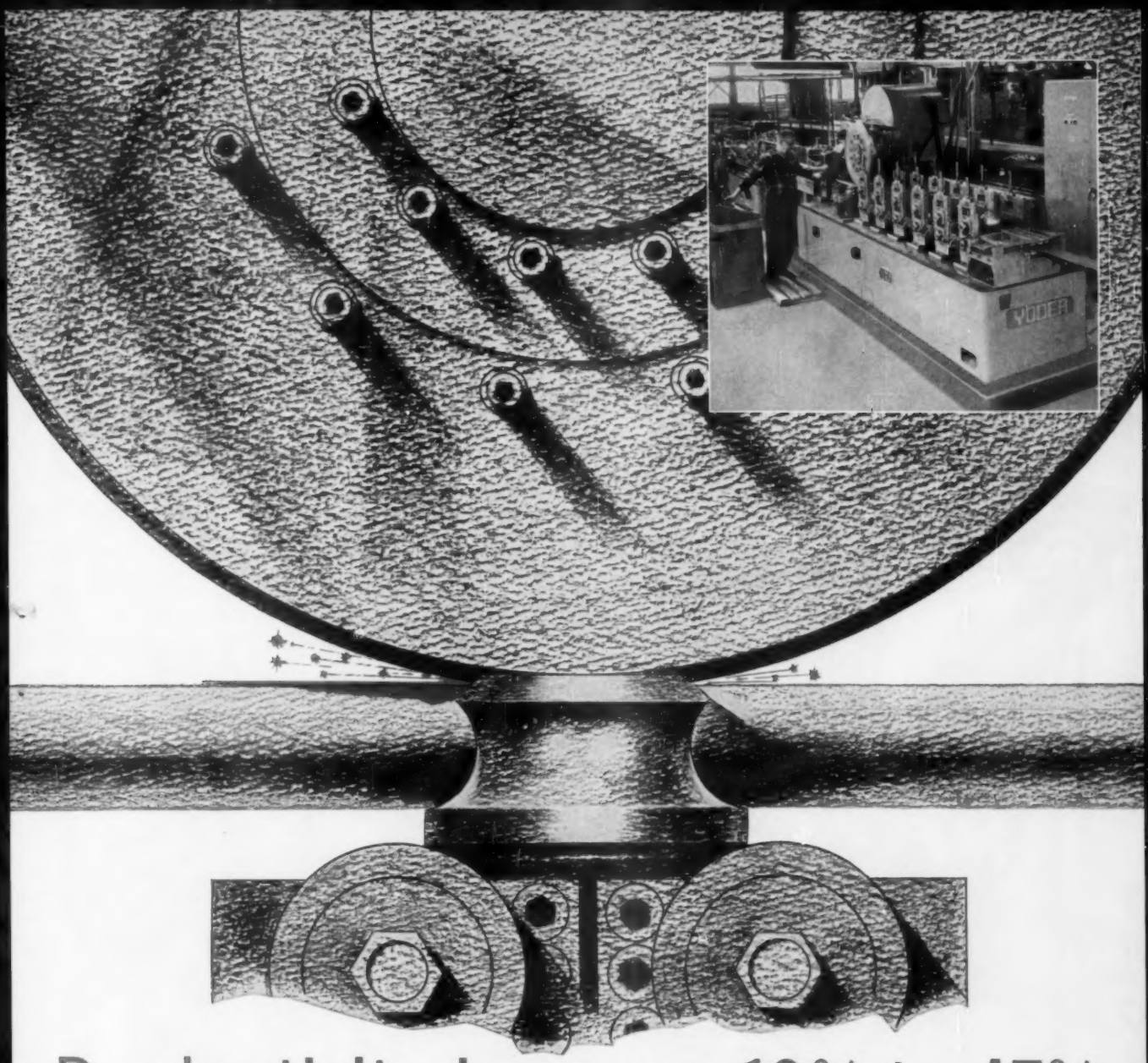
Star Cutter Company

Originators of Accurate Unground-Form Hobs

34500 GRAND RIVER AVE., FARMINGTON, MICHIGAN

Telephone: (Detroit), KEnwood 3-1100





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"TYPE V" PIPE AND TUBE WELDER . . . VAPOR COOLED!

Thousands of hours of tests and actual production point up the major productivity increases achieved by the new Yoder "Type V" Welder. The new Welder is available as a replacement unit for existing equipment or as an original component of a new Yoder pipe or tube mill.

The advanced design and engineering of the Yoder "Type V" Welder is described in a new brochure. This valuable information can be yours by return mail. Send the coupon at the right . . . today!

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Gentlemen:

Please send me full details on the new Yoder "Type V" vapor-cooled pipe or tube welder.

Name_____ **Position**_____

Company_____

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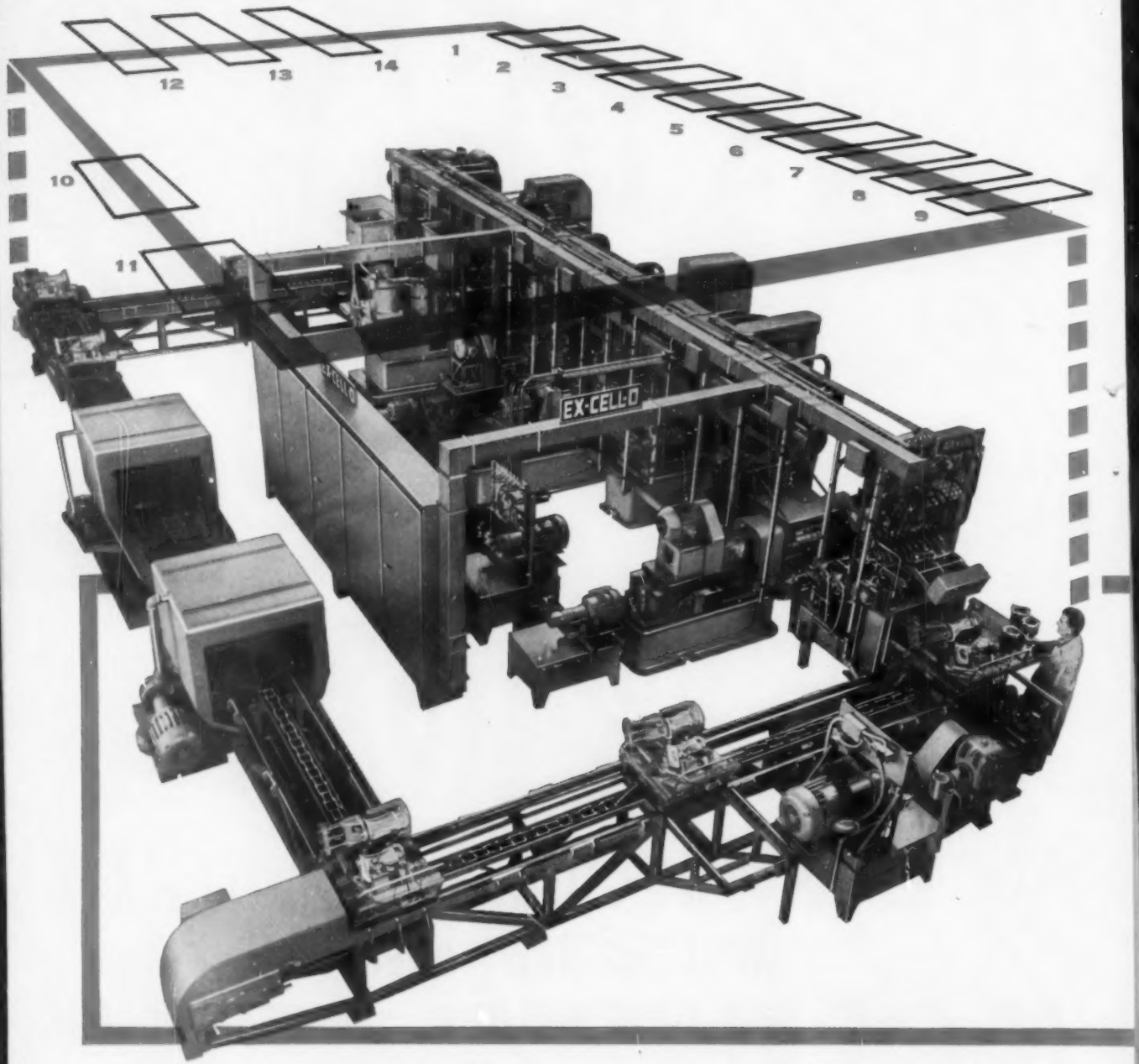
Ex-Cell-O Transfer Machine bores,



1 Unload, reload, load. Left and overhead: air-operated nut-runners.

2 Left: rough bore, counterbore, chamfer O.D. Right: rough bore, turn, face.

3 Left: idle. Right: drill two .265" holes vertically.

4 Left: idle. Right: probe two holes drilled at Station 3. Core-drill and spot-face one hole vertically.

5 Left: drill four 25/64" holes. Right: drill two 21/64" holes, combination drill and ream two .328" holes.

6 Left: finish bore, counterbore and chamfer. Right: drill one 13/64" speedometer lock-screw hole vertically.

7 Left: press in plain bushing. Right: finish-bore, chamfer hole roughed at Station 4.

8 Left: finish bore bushing diameter, finish counterbore. Right: chamfer, form undercut, finish face.

9 Left: idle. Right: tap three 1/4-20 UNC holes vertically.

10 Jet-wash pallet.

11 Blow-off pallet.

12, 13, 14 Unassigned (for future operations).

counterbores, chamfers, faces, drills and taps aluminum transmission units faster than two per minute!

AUTOMATED for high-speed machining—Completely automatic rough-to-finish machining of aluminum transmission extensions is made possible by single-operator control system governing Ex-Cell-O pallet-return transfer system. Output is 124 parts per hour.

PALLETIZED for efficient parts handling—Designed to accept two different components, 18 pallets index in each cycle, carry each part through the machine twice. Parts are loaded, unloaded manually, using power clamp mechanism.

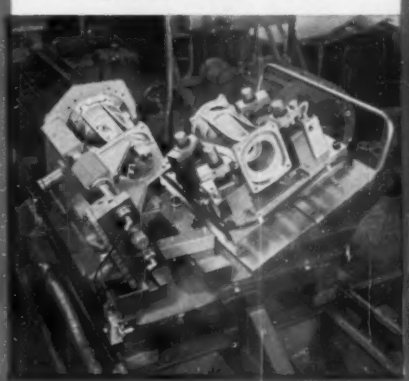
STANDARDIZED for lower initial cost, fast change-over—Spindles, CTW cutting tools, conveyors, torque actuators, worm reduction gearsets, drill bushings and other components are all built by—and backed by—Ex-Cell-O divisions and subsidiaries.

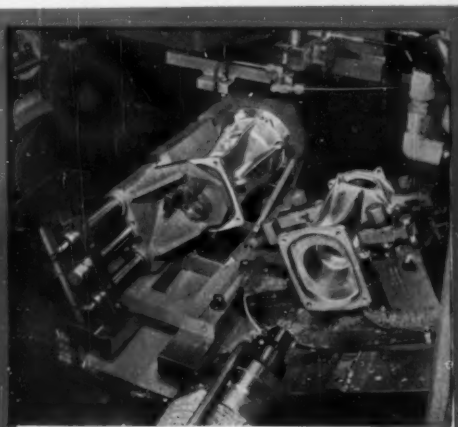
PRECISION-BUILT for unvarying accuracy—Extremely close tolerances are double-checked by inbuilt air-gage stations. Machine holds .0005-inch tolerances on finished bore diameters. Ultra-Precision Ex-Cell-O Spindles are used for all boring operations.

Do you have a large or small part that should be produced faster, more accurately? Your Ex-Cell-O Representative will be pleased to analyze your part or print and show you how an Ex-Cell-O Standard or Special can do the job for you.

Aluminum transmission parts vary in length and shape. Adjustable pallets accept either of parts shown above.

Below, two parts are shown on pallet, oriented 180° to each other. At load station, operator unloads finished part, shifts partially-machined part to empty fixture, loads unmachined casting on opposite side.





At bottom above, Ultra-Precision Spindle uses throw-away tooling. Vertical drill at rear of part at left is driven by Ex-Cell-O Hydraulic Power Unit.

61-28M

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PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • JIG AND FIXTURE COMPONENTS • TORQUE ACTUATORS • CONTOUR PROJECTORS GAGES AND GAGING EQUIPMENT • GRANITE SURFACE PLATES • COMPUTER PRODUCTS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • ATOMIC ENERGY EQUIPMENT • DAIRY AND OTHER PACKAGING EQUIPMENT

Machinery Division

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

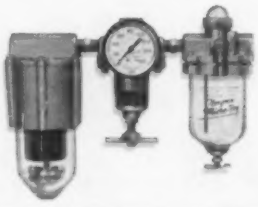
Norgren Lubro-Control Units

*A complete line of **visible oil feed** lubricator units for air-tools, air cylinders and other air-powered equipment*

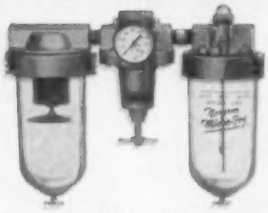
NORGREN Micro-Fog Combination Units

Easily adjustable for the exact amount of lubrication required

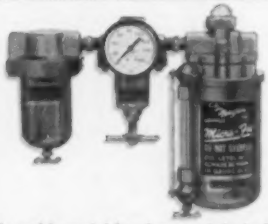
Transparent bowl filter; pressure regulator with gauge; transparent bowl Micro-Fog Lubricator. ⅛" pipe size. ½ oz. lubricator capacity. Small, compact unit for use where space is tight.



Transparent bowl automatic-drain filter; regulator with gauge; transparent bowl, Micro-Fog Lubricator. ¼", ⅜", ½", ¾", 1" pipe sizes. ½ pt. lubricator capacity.



Transparent bowl manual-drain filter; pressure regulator with gauge; transparent bowl, Micro-Fog Lubricator. ¼", ⅜", ½", ¾", 1", pipe sizes. 2½ pts. lubricator capacity.

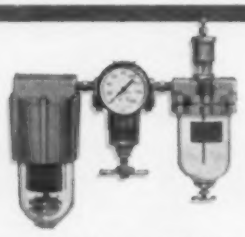


Replaceable metal bowl manual-drain filter; pressure regulator with gauge; replaceable metal bowl, Micro-Fog Lubricator with constant oil level. ¼", ⅜", ½", ¾", 1" pipe sizes. 1 qt. lubricator capacity.

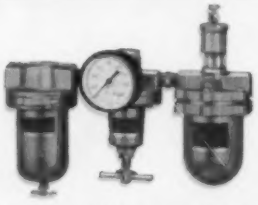
Compact cabinet unit for air operated machine tool applications. Provides filtered air, accurate regulation and control of oil delivery, visible, adjustable oil feed. ⅛" pipe size. 10 oz. oil capacity.

NORGREN Oil-Fog Combination Units

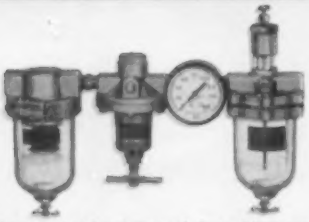
Efficient, effective lubrication of air-powered equipment.



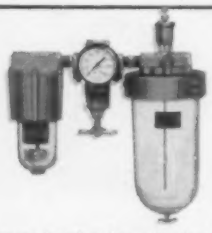
Transparent bowl automatic-drain filter; regulator with gauge; transparent bowl lubricator. ¼", ⅜", ½", ¾", 1" pipe sizes. ½ pt. lubricator capacity.



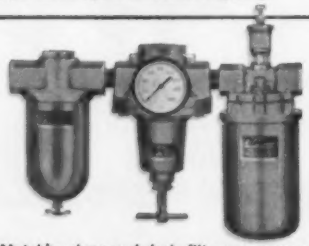
Replaceable metal bowl manual-drain filter; pressure regulator with gauge; replaceable metal bowl lubricator. ¼", ⅜", ½", ¾", 1" pipe sizes. ½ pt. lubricator capacity.



Transparent bowl manual-drain filter; pressure regulator with gauge on tee; transparent bowl lubricator. ¼", ⅜", ½", ¾", 1" pipe sizes. ½ pt. lubricator capacity.



Transparent bowl automatic-drain filter; pressure regulator with gauge; transparent bowl lubricator. ½", ⅜", ½", ¾", 1" pipe sizes. 1¼ qt. lubricator capacity.



Metal bowl manual-drain filter; pressure regulator with gauge; replaceable, metal bowl lubricator. ¾", 1" pipe sizes. 1 qt. lubricator capacity.

Shown here are a few models from Norgren's complete line of air filters, pressure regulators and lubricator units. For full information, call your nearby Norgren representative listed in your phone directory, or write for descriptive literature.

C. A. NORGREN CO.

3447 SOUTH ELATI STREET • ENGLEWOOD, COLORADO

Using basic components, seven different arrangements are possible, as shown above. Spindle drive motors can be mounted at right, left, or on both sides with single or double spindles; two machines can be placed side-by-side or used with other production machines.

The 4 BIG Features of Ex-Cell-O's New 411 Vertical Are Important To You

1. QUICK TOOL CHANGING—Tool changing and adjusting is fast and easy because of "clean" design and placement of the Model 411's components.

2. EASY PARTS HANDLING—Vertical construction lends itself to safe, easy loading and unloading of parts in a wide variety of shapes and sizes.

3. SINGLE COLUMN CONSTRUCTION—Solid base-column gives firm support to the hydraulically-operated compound tool slide. Rugged, simple construction assures maximum accuracy and efficiency, plus long life with lowest maintenance.

4. PRODUCTION VERSATILITY-The all-new Model 411 performs turning, boring, facing, grooving, limited contouring and chamfering operations singly or in combination. Often, both sides of disc-type parts can be machined simultaneously.

Contact your Ex-Cell-O Representative or write direct for details.

61-60M

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Machinery Division

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

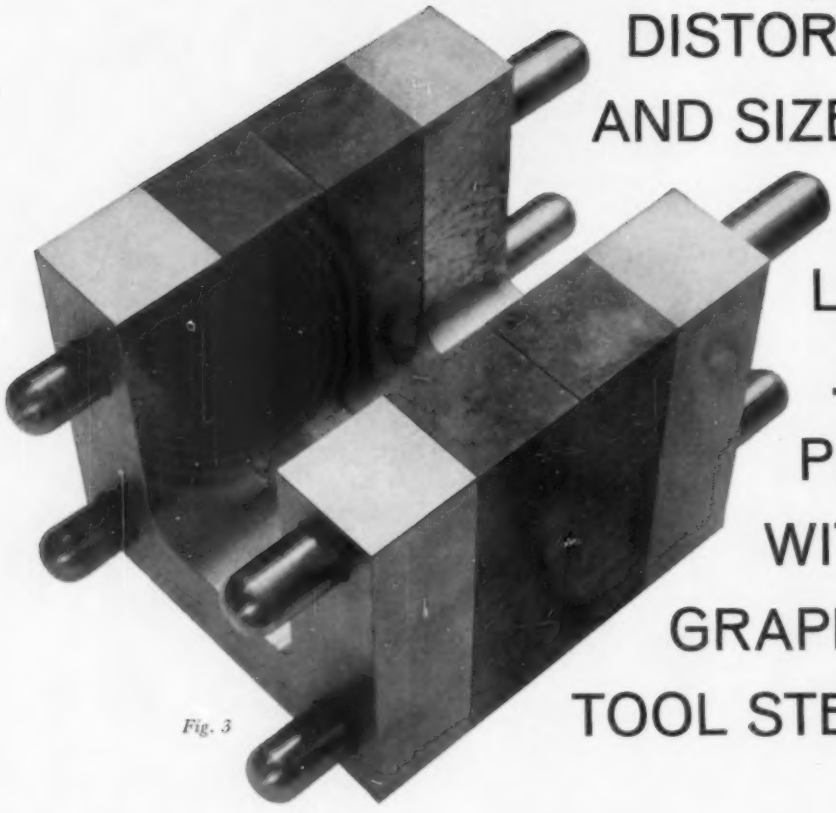


Fig. 3

DISTORTION AND SIZE CHANGE HELD TO LESS THAN .0002" PER INCH WITH GRAPH-AIR® TOOL STEEL

The test pieces pictured here demonstrate the dimensional stability of Graph-Air® tool steel that enables users to produce more intricate tools and dies.

Fig. 1 shows test piece dimensions. In the "U" shape, which is particularly sensitive to distortion in heat treating, the machining tolerance between any two holes is held to .0002". After heat treating, the specimens are fitted together by four pins having a diameter of .0003" under .500". The total assembly error under these circumstances could not exceed .0008". Distortion must be less than .0002" per inch during heat treatment for the pins to fit.

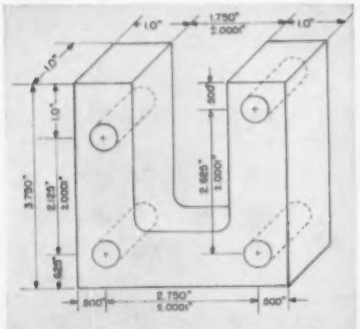


Fig. 1

The Graph-Air pieces tested were from different heats. They were air hardened from 1450°F. and double tempered at 400°F. Fig. 2 shows them as they pegged together easily, demonstrating no distortion. Fig. 3 top, shows the same specimens compared with two green, or as machined, parts. They matched perfectly again. *Graph-Air did not distort . . . did not change size.* Records indicate that no other tool steel passed this test when heat treated at its recommended hardening and tempering conditions.

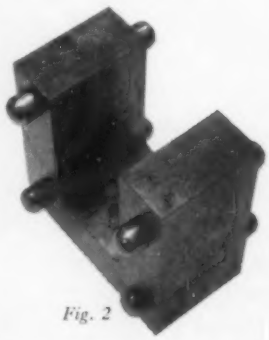


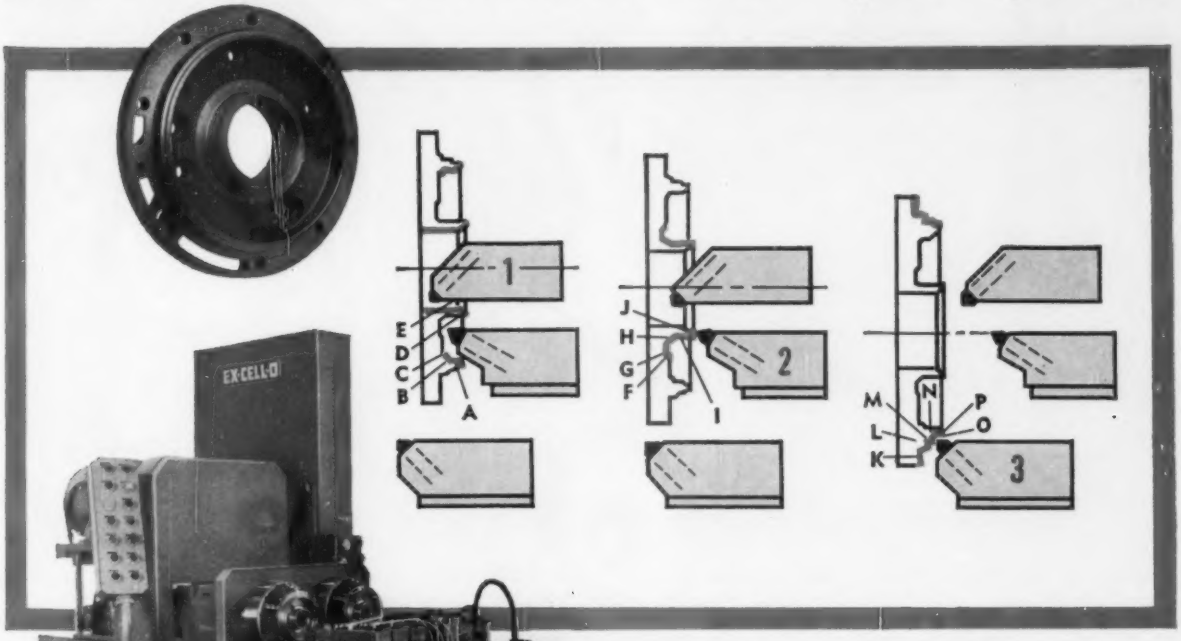
Fig. 2

Specify Graph-Air where minimum distortion and high quality are required. Solid and hollow bar sizes available. It is one of the Timken graphitic tool steels, the most stable tool steels made. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO". Makers of Tapered Roller Bearings, Fine Alloy Steel and Removable Rock Bits.

TIMKEN®
Fine Alloy STEEL

TIMKEN GRAPHITIC STEELS ARE AVAILABLE FROM STEEL SERVICE CENTERS IN MORE THAN 40 CITIES IN THE UNITED STATES AND CANADA

Ex-Cell-O Model 312 generates 21 surfaces per part!



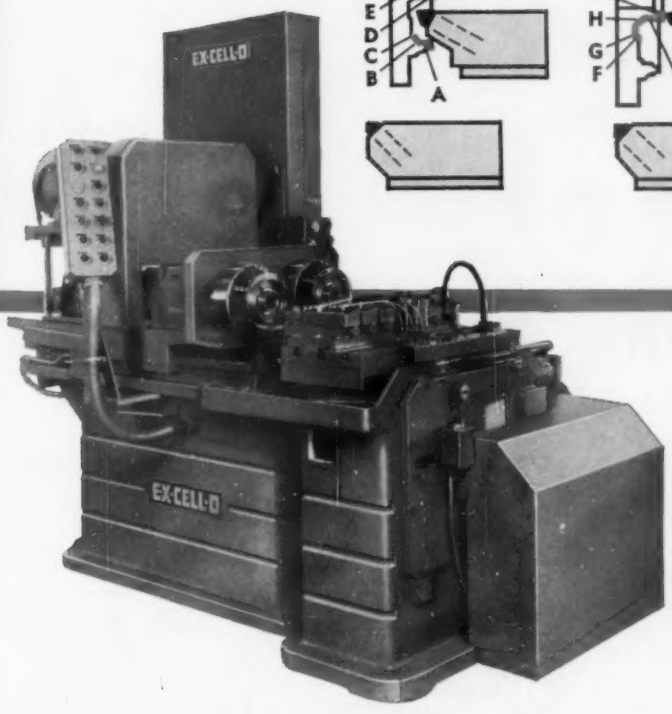


Diagram shows tools in quick-change magazines at the end of their strokes.

Tool No. 1 generates chamfer A, bores diameter B, generates radius C, traverses out, chamfers D and bores E.

Tool No. 2 generates surfaces F, G, H, I, and J with cam-controlled accuracy.

Tool No. 3 faces K, generates radius L, tapers M, turns N, chamfers O and generates radius P in cast-iron clutch assemblies.

Ex-Cell-O Cam-Operated Precision Boring Machines are designed especially for work requiring consistently precise boring, plunge-facing, grooving, chamfering and other O.D. and I.D. contours. Table and slide movements on hardened and ground ways are guaranteed by direct cam action—there are no levers, no complex linkages. For maximum accuracy, cams can be ground for you in our plant on numerically-controlled machines.

Two models, 308 and 312, rough, semifinish and finish a wide range of parts. Ask your Ex-Cell-O Representative for data, or write direct for details.

61-17M

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PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • JIG AND FIXTURE COMPONENTS • TORQUE ACTUATORS • CONTOUR PROJECTORS GAGES AND GAGING EQUIPMENT • GRANITE SURFACE PLATES • COMPUTER PRODUCTS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • ATOMIC ENERGY EQUIPMENT • DAIRY AND OTHER PACKAGING EQUIPMENT

Machinery Division

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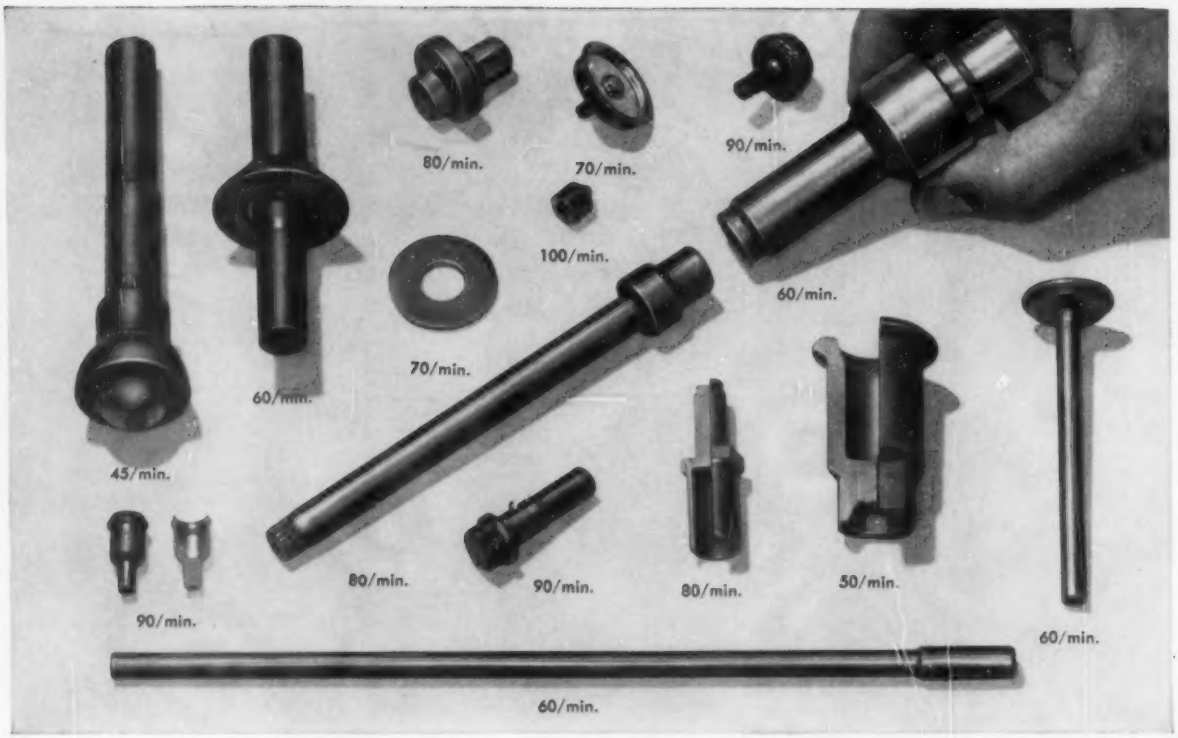
DETROIT 32, MICHIGAN



PARTS "BORN" TO shape!

Cold-formed from wire, these difficult-to-make parts now bring substantial savings.

Production – automatic, high speed, efficient.

Stock – economical coiled wire.

Scrap – minimum; none in many cases.

Finishing operations – few; some parts ready to use.

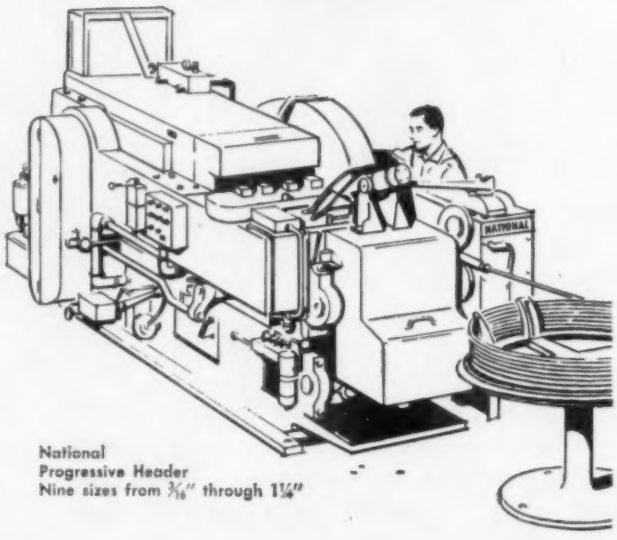
Quality – the best; forged strength and reliability.

Savings – of material and time.

NATIONAL PROGRESSIVE HEADERS are now able to form many unusual shapes automatically, because you have (1) Better coiled wire; (2) Improved die materials and lubricants; (3) Economy-minded engineers designing for cold forming; (4) Engineering assistance to help you flow metal.

If you make odd-shaped parts, come to Tiffin, and let us help you evaluate them for production from wire.

No obligation.



National
Progressive Header
Nine sizes from 3/16" through 1¼"

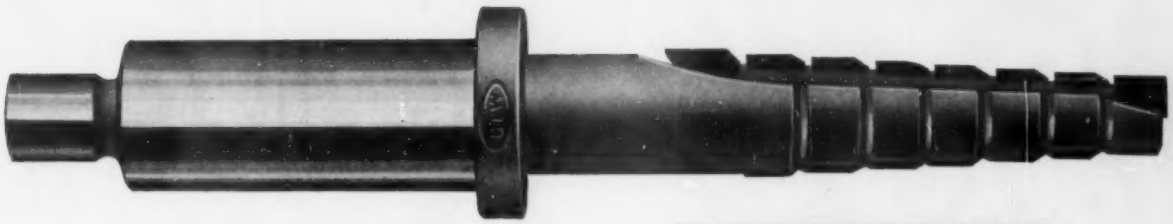
FORGING MACHINES • MAXIPRESSES • REDUCEROLLS
BOLTMAKERS • NUT FORMERS • TAPPERS
COLD HEADERS • PARTS-MAKING MACHINES

NATIONAL MACHINERY CO.

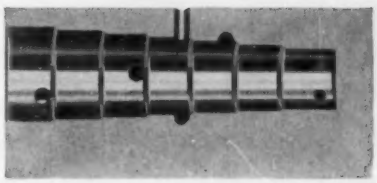
TIFFIN, OHIO, U. S. A.

HARTFORD **DETROIT** **CHICAGO**

Seven Diameters . . . from solid to finish with one tool, one pass!

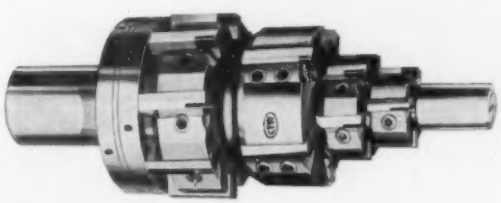


Special CTW Bor-Reamer bores and chamfers seven diameters from solid to finish in one operation. Tool is carbide-tipped, uses carbide bearing pads to maintain .001" tolerance on bore size and concentricity. Cut-away photo at right shows ID detail of non-ferrous aircraft part.



Imagine the setup and machining time *you* might save with a single Continental Special Cutting Tool custom-designed to combine two or more operations, to take multiple cuts, or to mill complex contours!

Why not let CTW combine your operations on production or short-run jobs? A call to your local CTW Representative will immediately put 40 years of cutting tool research, engineering and manufacturing experience to work for you. Call him today, or write direct for details.



Inserted-blade special cutter, left, finishes four diameters and four shoulders in one pass. Tungsten carbide-tipped cutter at right combines two-step boring, hollow milling and plunge-facing in one tool.

DESIGN FEATURES TESTED IN EX-CELL-O'S OWN MANUFACTURING PLANTS . . .
PRODUCTION-PROVED IN CUSTOMERS' PLANTS THROUGHOUT THE WORLD!

61-34C

Continental CTW TOOL WORKS
DIVISION OF EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

ANOTHER CUSHMAN PINCH JAW CHUCK AT WORK!

Cushman has designed and engineered a complete line of both automatic and hand operated, torque controlled pinch type chucks featuring pinch units exerting gripping pressures of over 2,000 lbs. at 85 p.s.i. with workpiece lift limited to approximately .0002". These chucks are extremely adaptable to machining missile components and equally well suited for holding a range of products from rings of small cross section to large complicated weldments on either vertical or horizontal machines.

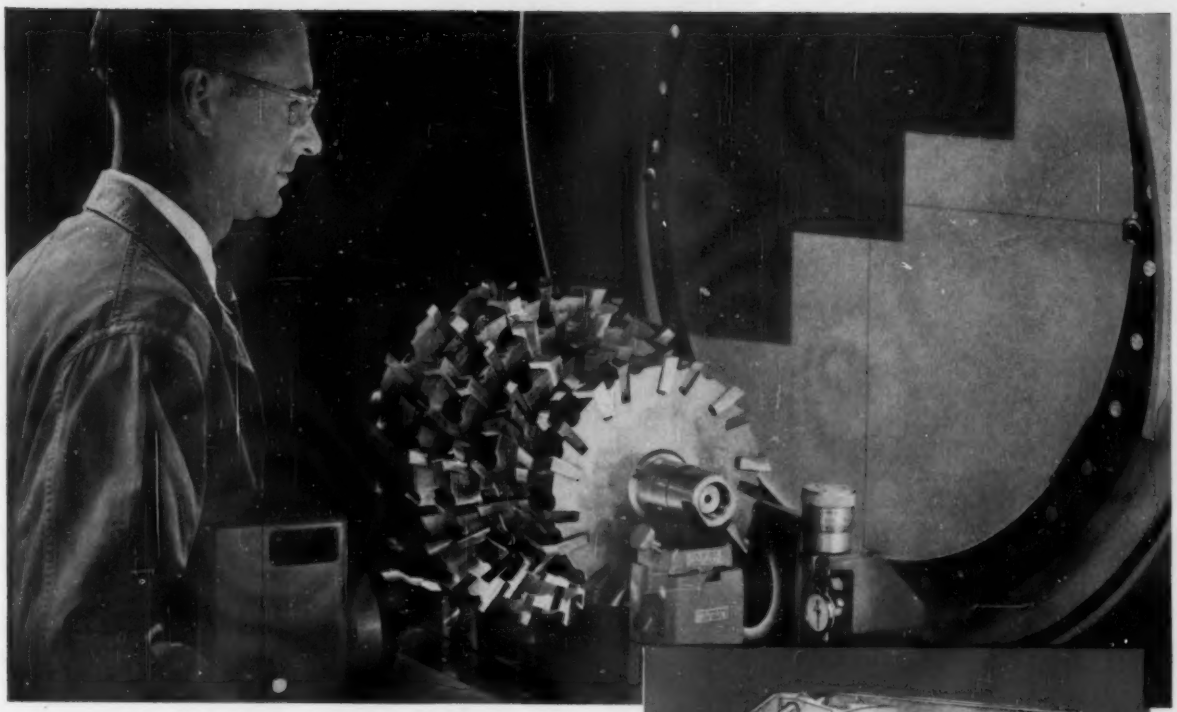
CUSHMAN CHUCKS,
a product of American quality,
labor and materials.

Sold through
your industrial
distributor.

THE CUSHMAN CHUCK COMPANY

hartford 2, conn.

7CS58R



Built by EX-CELL-O

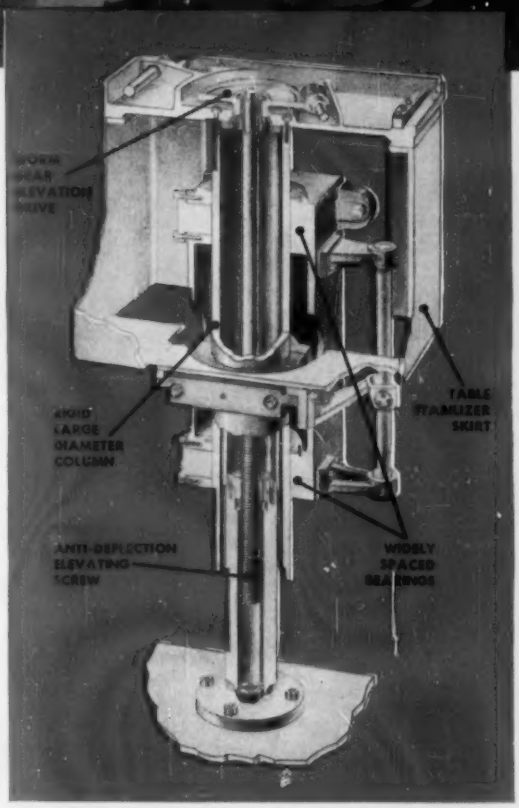
To Insure Accuracy

Rugged, precision construction of Ex-Cell-O Contour Projectors results in stable support for the optical systems providing accuracy in the order of .0001". This rigidity is a major consideration in achieving for Ex-Cell-O Projectors an outstanding record of trouble free operation and almost total elimination of down time.

Typical of the sturdy, precision workmanship to be found throughout Ex-Cell-O Contour Projectors is the worktable of the Model 14-5 and Model 30. Engineers will recognize the superior design features shown in the inset at right. To cite just a few, the large 5" O.D. columns, supported in widely spaced bearings; the heavy channel skirt to stabilize the table assembly and the flexible elevating screw which can't impart deflections to the column.

Because of these construction features Ex-Cell-O Contour Projectors support heavy loads firmly, yet move easily and smoothly.

Whether your problem involves receiving, production or final inspection there's an Ex-Cell-O Contour Projector to do the job accurately, quickly and at low cost. The "why" and "how" is condensed in our new booklet—"43 Reasons Why Ex-Cell-O Contour Projectors are the First Choice of Industry." Yours for the asking!



Manufactured by EX-CELL-O Corporation at Detroit, Mich.

SOLD AND SERVICED BY

CP61-2

OPTICAL GAGING PRODUCTS, INC.

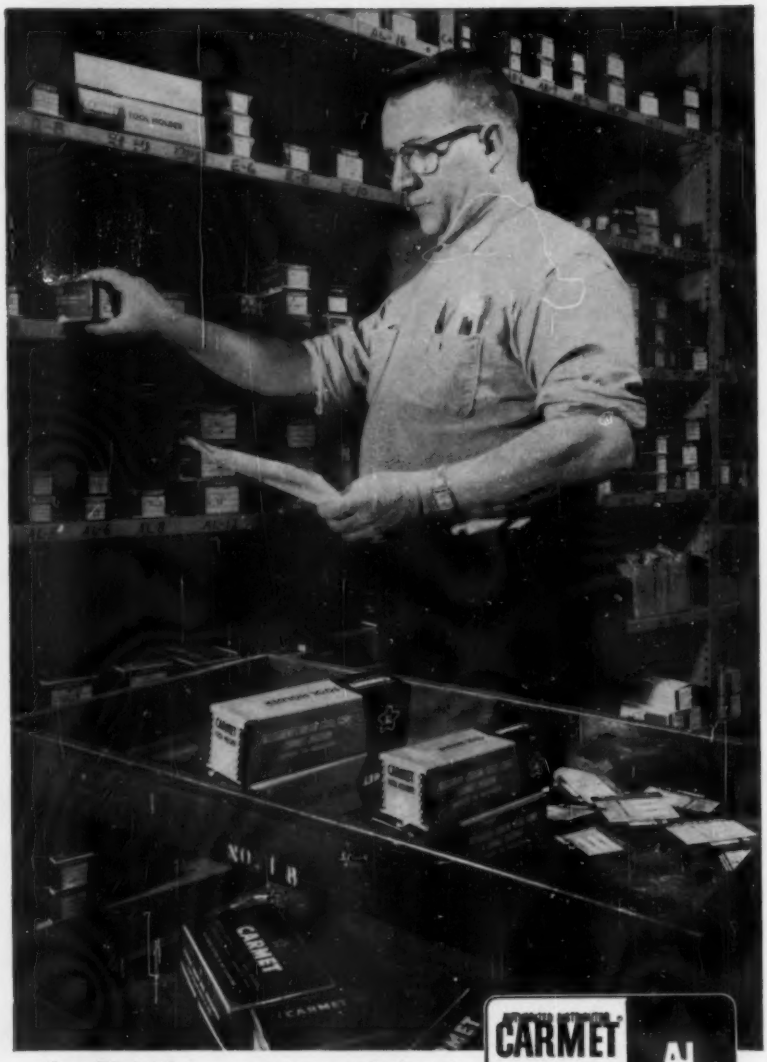
26 FORBES STREET ROCHESTER 11, N. Y.

Subsidiary of EX-CELL-O Corporation

Use Reader Service Card, CIRCLE 38

Use Reader Service Card, CIRCLE 39

Off-the-shelf delivery of Carmet® Carbide Tools from your local CARMET Distributor



Over 75 distributors, coast to coast, display this sign—service in your own local area.

Keep your inventory of Carmet Carbide Tools at a comfortable level. Keep your working capital free for other needs. Your Carmet distributor carries the load—that's how he's set up to do business.

He carries your needs from the complete line of Carmet Carbide Tools in all grades and every style. He is geared to deliver your orders quickly—a phone call gets action.

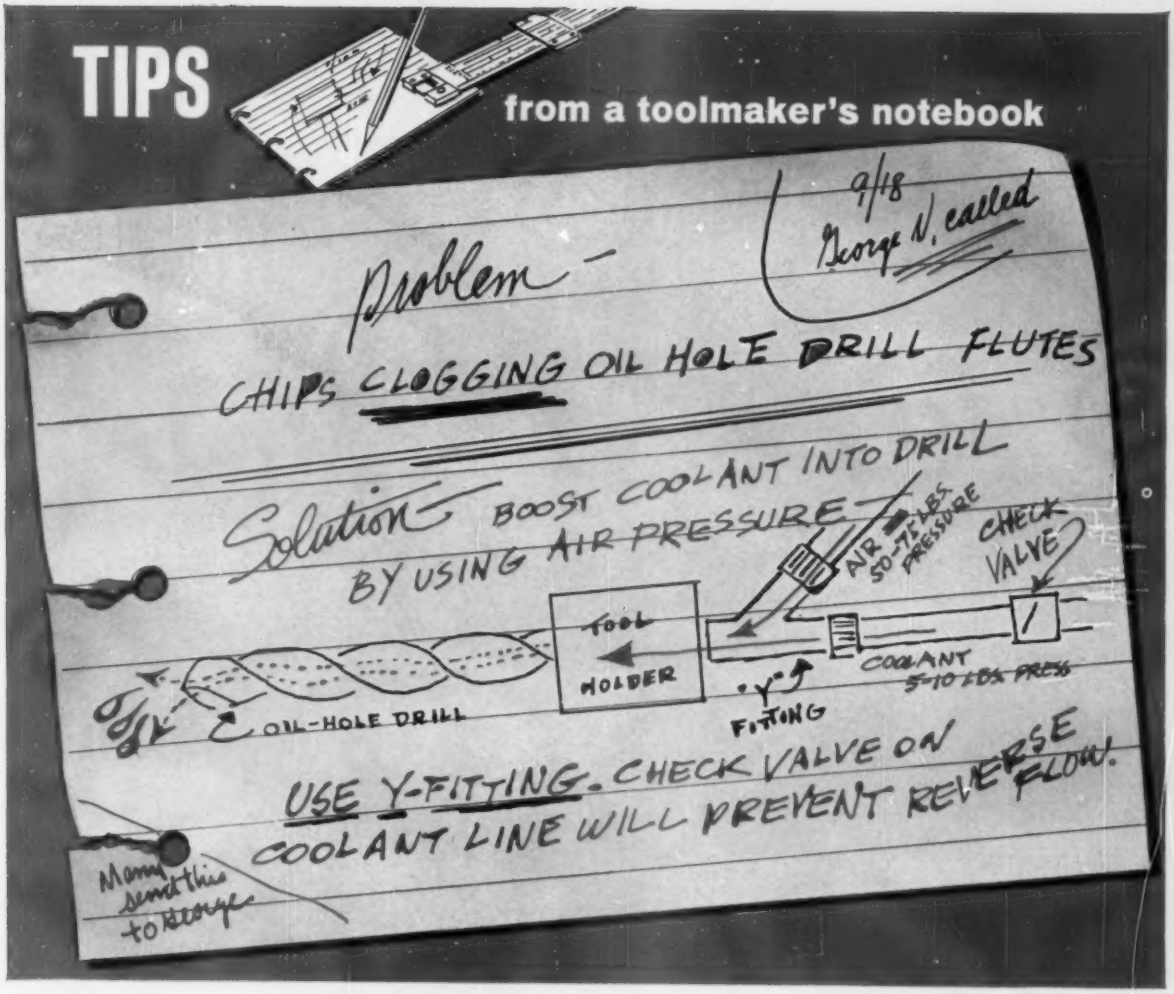
And if you get in a production jam, special service is his middle name. Remember, your Carmet distributor knows carbide tooling—with the help of the local Carmet technical man, you get all the help you need.

Your Carmet distributor handles the best Carbide Tools and backs it with the best service! ***Allegheny Ludlum Steel Corporation, Carmet Division, Ferndale, Detroit 20, Michigan. Dept. TE-12-1.***

CARMET® AL

CEMENTED CARBIDE • DIVISION OF ALLEGHENY LUDLUM

1300



It's the business of engineers at Chicago-Latrobe to solve metal-cutting problems. Whether it's a case like the one above or a sophisticated setup involving tape control, C-L is certain to have experience that can save you time and money.

Begin the contact by calling in your local C-L Distributor or C-L Sales Engineer ...or by writing Chicago-Latrobe direct...do it today.

Do you have a C-L catalog? It is free on request.

C-L
CHICAGO-LATROBE

INDUSTRIAL DISTRIBUTORS · THE RIGHT HAND OF PRODUCTION

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THE PIPE MACHINERY COMPANY

MANUFACTURERS OF

PIPE FINISHING MACHINERY, (THREADING-FACING) AUTOMATIC HANDLING TABLES
A.P.I. RECEDING DIES & TAPS, CHASERS AND CUTTING TOOLS
GAGES, (STANDARD AND SPECIAL)

QUOTA

29100 LAKELAND
WICKLIFFE. C

To Martin & Hay In
4692 Maine
Chicago, I

Date June 14, 196

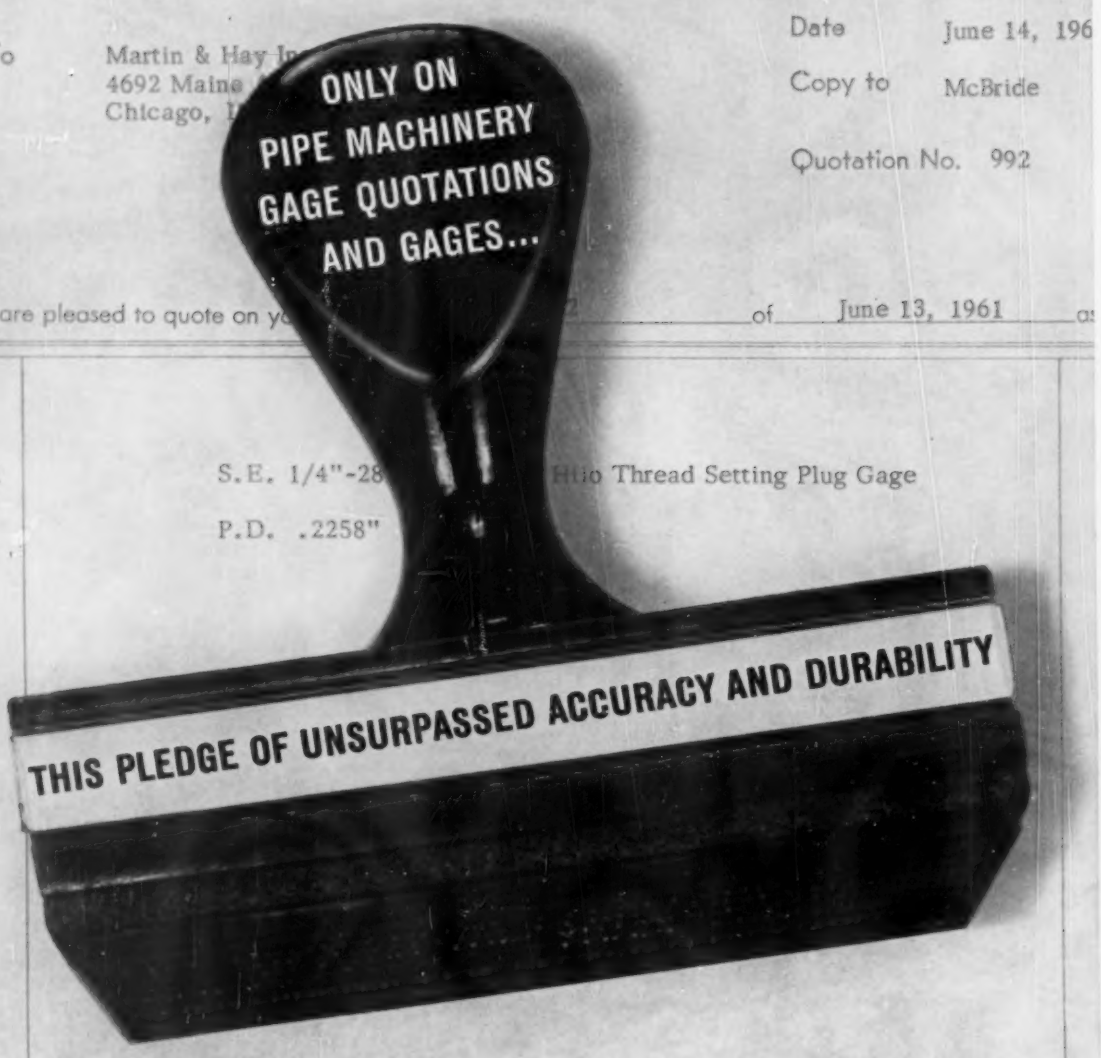
Copy to McBride

Quotation No. 992

We are pleased to quote on yo of June 13, 1961 a

1 S.E. 1/4"-28 Hlio Thread Setting Plug Gage

P.D. .2258"

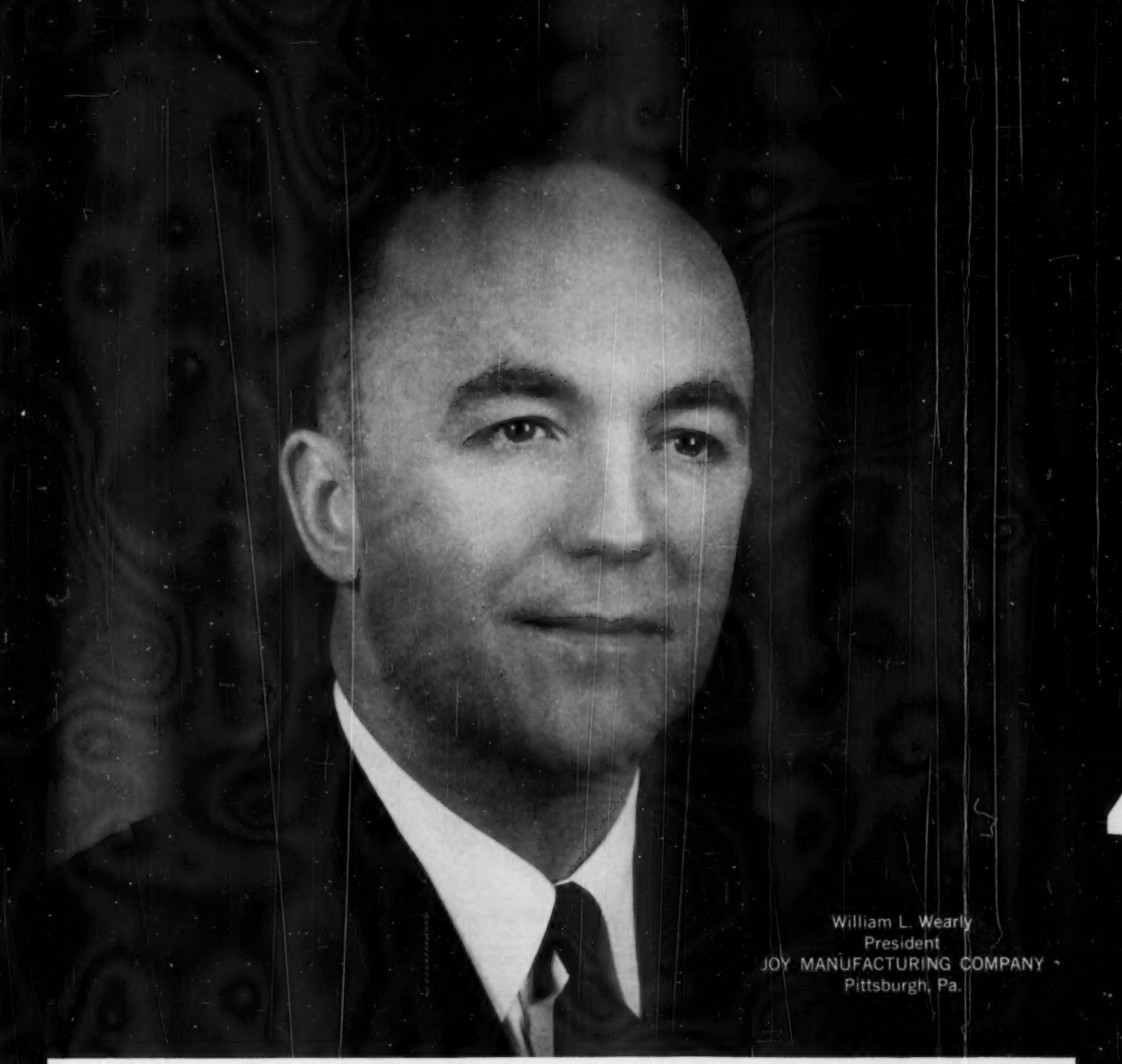


"Gages quoted on basis of furnishing rings lapped with a plug lap, and plugs lapped with a ring lap, to remove soft grinding skin, fat end thread, drunken thread, grinding chatter, and to produce a low micro finish. This operation is necessary to insure gage accuracy and long life. All gages will be stabilized by deep freezing to insure dimensional stability.

Lead error, including drunkenness, shall not be greater than lead tolerance shown in H-28 handbook."

For further details on our complete line of high quality gages write us on your company letterhead today.

THE PIPE MACHINERY COMPANY · 29100 Lakeland Boulevard · Wickliffe, Ohio · Greater Cleveland



William L. Wearly
President
JOY MANUFACTURING COMPANY
Pittsburgh, Pa.

"THE MACHINE TOOL GAP...
a threat to our world leadership"

"Industry's ability to increase productivity through modernization of equipment and plants has enabled this country to keep ahead of the rest of the world. Through modernization we have offset the advantage foreign manufacturers have with their lower labor costs.

"Failure to rehabilitate obsolete plants and equipment has narrowed the margin of superior productivity and quality. This rapidly developing 'machine tool gap' can cause loss of world leadership and impair our national security.

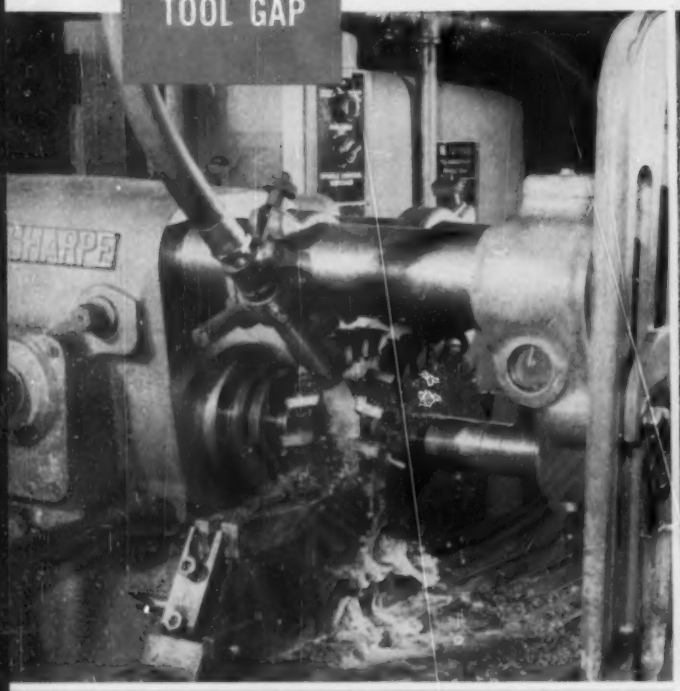
"At JOY MANUFACTURING COMPANY we recognize that every dollar invested in modern machine tools works for us and for our nation."

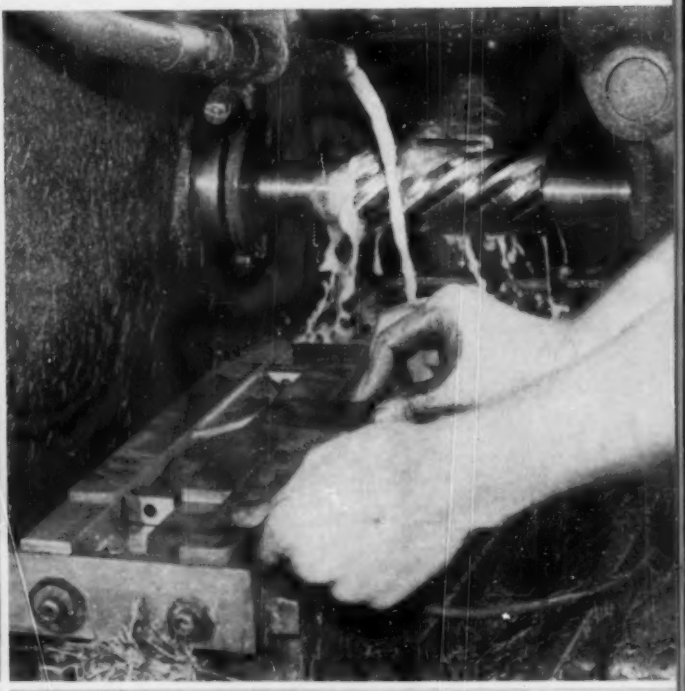
This statement reprinted courtesy of Joy Manufacturing Co.

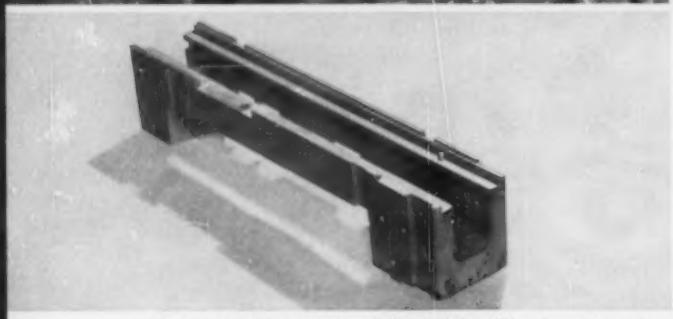
Brown & Sharpe

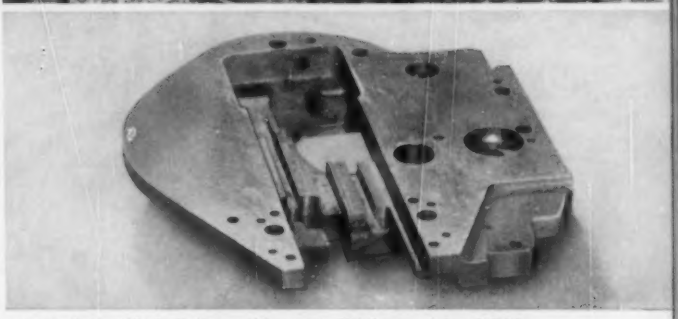
Close the MACHINE TOOL GAP

MODERNIZE MILLING AND MAKE MORE FOR LESS









Typical operations are (top left) straddle-milling 3 surfaces of a malleable iron bonnet casting. — (top right) loading a B&S Magnetic chuck used for holding CRS parts while flat surfaces are helical milled. Both machines are 7½ hp models of B&S No. 12. The two other parts shown, with machining completed, illustrate the variety of milling cuts required.

BOSTITCH relies on proved cost-saving of B&S No. 12– builds up production-milling battery to 14 machines

Brown & Sharpe
No. 12 Plain Milling Machine
3, 7½, and 10 hp

At BOSTITCH, Inc., manufacture of staplers and wire-stitching equipment requires multi-cut milling on many different parts. For highest efficiency, ready adaptability, and cost economy, their production staff has long relied on Brown & Sharpe No. 12 Plain Milling Machines. With recent additions, chosen on the basis of proved performance, 14 machines are now in operation.

The many-shaped pieces are held in simple fixtures, and the wide choice of No. 12 automatic milling cycles are fully utilized. Operators simply load and unload the fixture, can tend two or more machines.

On many parts, several surfaces are milled at once with ganged cutters. The automatic climb milling arrangement on the No. 12 makes it possible to take full advantage of higher cutting loads with either conventional or climb milling set-ups. Tolerances within ±.001", required for a number of parts, are easily met.

For top returns on your investment in production milling equipment, the B&S No. 12 leads in cost-saving performance. All the operating features needed for fully automatic milling are standard. With special fixtures, you can equal the output of an expensive, single-purpose machine. And, when the work changes, you just change the fixtures, *not* the machines. For details, write: Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.

Brown & Sharpe PRECISION CENTER

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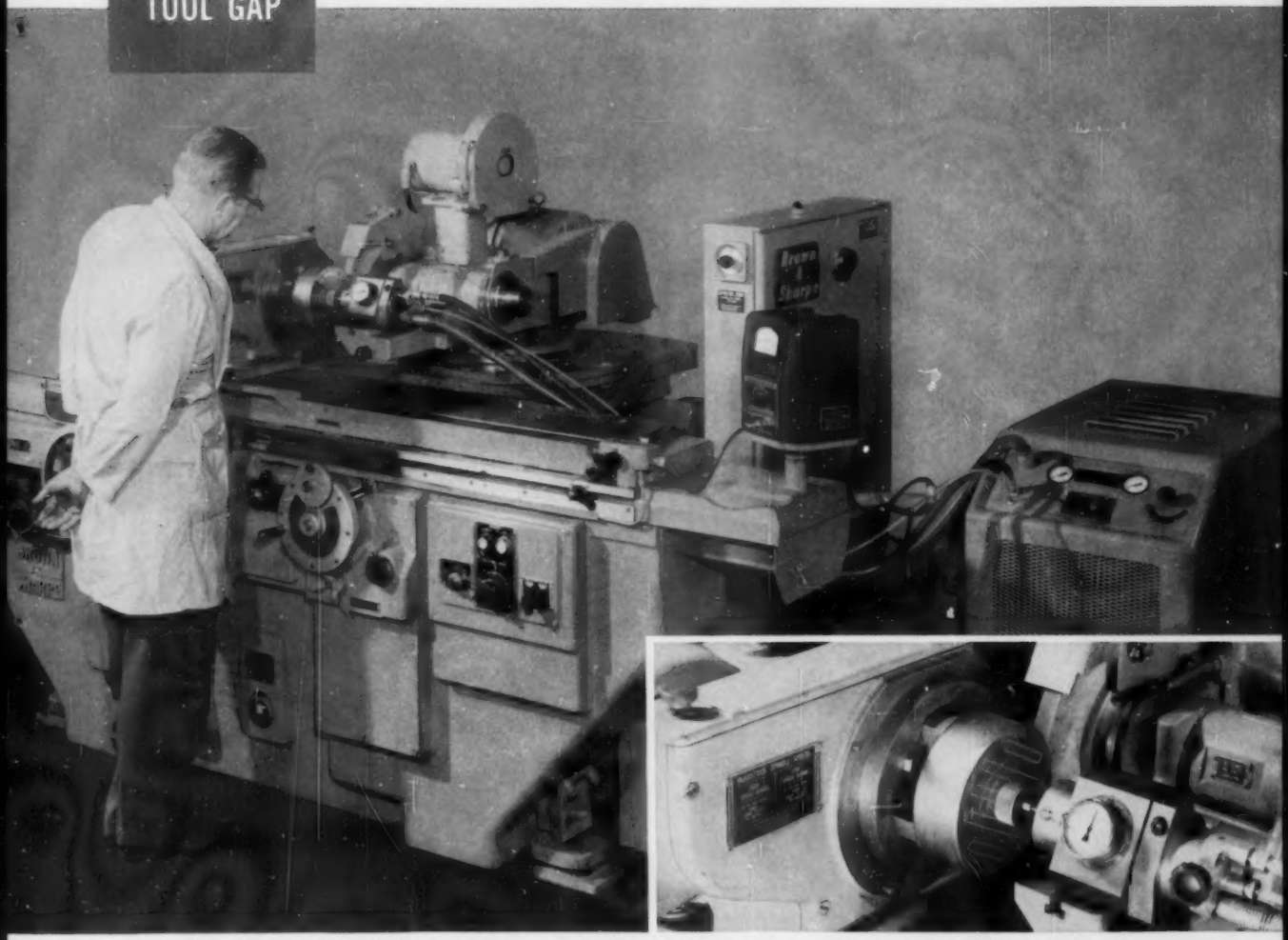
Close the MACHINE TOOL GAP

MODERNIZE GRINDING AND MAKE MORE FOR LESS



The No. 2 Universal Grinding Machine (above) is equipped with the new Hydrostatic Internal Grinding Unit, shown (right). The machine is also equipped with the B&S Supercise Hydrostatic Headstock, which permits the same split-tenth precision in external grinding. The hydrostatic pressure control is shown at the right of the machine.

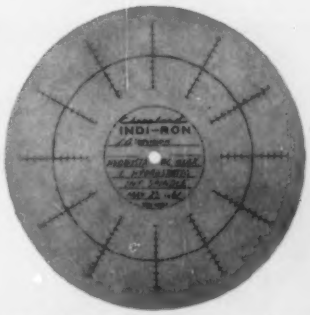
New B&S first - Hydrostatic Internal Grinding unit repeats hole size and roundness within 10 millionths

The Brown & Sharpe Universal shown is the world's first machine to provide repetitive *production* grinding to split-tenth precision in size and roundness, for both external and internal grinding. It is equipped with the B&S Supercise Hydrostatic Headstock as well as the new Hydrostatic Internal Grinding unit. The unique hydrostatic bearings automatically compensate for minute errors.

Roundness to 0.000010" or better, and straightness to a few millionths can be maintained in production runs by average operators, grinding with live or dead centers.

There is practically no limitation on the weight of the holding fixture. Contact wear of the spindles is virtually eliminated, since there is no metal to metal condition under rotation. Precision performance can be maintained through a wear-life at least 10 times that of conventional spindles.

The Supercise Hydrostatic Headstock and Internal Grinding unit are available as extra equipment on any of the four sizes of Universal Grinding Machines. They are the newest of many exclusive features of B&S Universals that permit job-time savings of 75% or more, and make them your best investment for toolroom, prototype, or production grinding. Why settle for less? For full information, write: Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.



Test chart indicates true roundness well within 10 millionths of an inch.

Brown & Sharpe PRECISION CENTER

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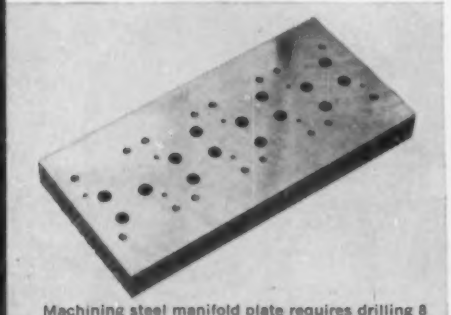
Close the MACHINE TOOL GAP

MODERNIZE DRILLING AND MAKE MORE FOR LESS

Twin set-up, automatic drilling on B&S Turr-E-Tape cuts production time 40% - eliminates jig expense



Machining steel manifold plate requires drilling 8 holes 3/8" dia. and 23 holes 3/4" dia. — drilling and tapping 18 holes 1/2"-13, and 8 holes 3/4"-14 N.P.T.

At F. J. Stokes Corporation, Philadelphia, manufacture of plastic molding and other processing machinery calls for numerous short runs of parts for custom built equipment. With Turr-E-Tape, the Brown & Sharpe tape-controlled Turret Drilling Machine, drilling and tapping operations are performed at an average saving of 50% in floor-to-floor time over the previous jig-drilling on a radial drill press.

In the set-up shown, 31 holes are drilled and 26 drilled and tapped in a valve manifold plate, with a production time saving of 40%. The parts are held in simple universal fixtures clamped to the positioning table. With the double set-up, one part is machined while the other fixture is unloaded and reloaded by the operator using a magnetic conveyor-hoist.

Indexing, starting and stopping of tool operations, and accurate hole-positioning are all performed automatically, at the "command" of punched tape in the numerical positioning control.

If your production requires numerous short runs, or long runs of parts used a few at a time, find out how much you can save with the Turr-E-Tape... in tooling costs, in non-productive time, in skilled labor costs. Write: Machine Tool Division, Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.

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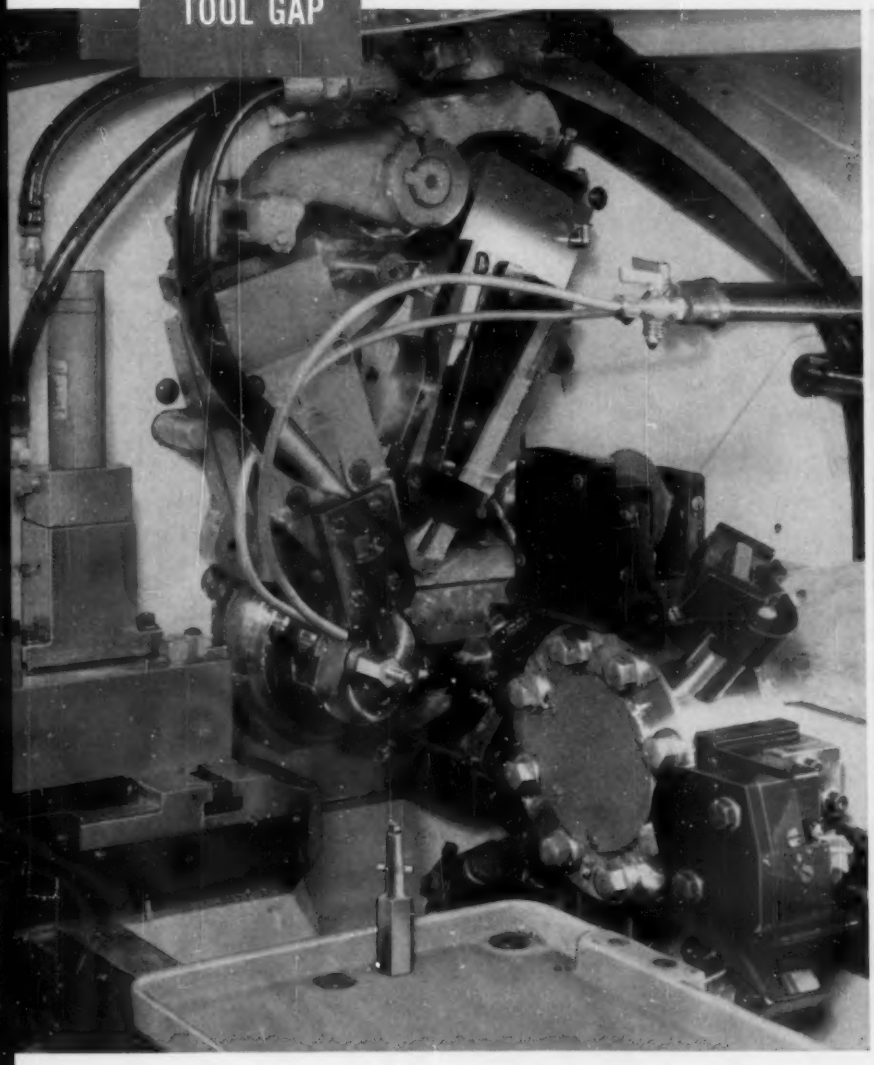
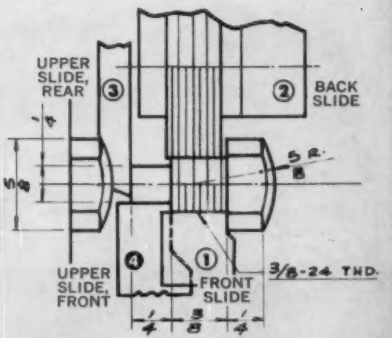
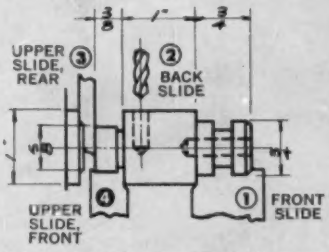
Close the MACHINE TOOL GAP

MODERNIZE SCREW MACHINING
AND MAKE MORE FOR LESS

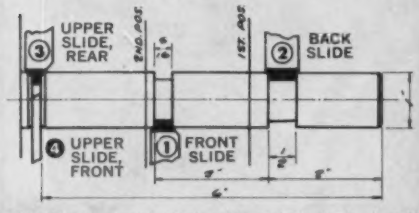




Production increased 25% Use of Fourth Slide eliminates slow swing-tool operation . . . also eliminates wide form tool (1 and 4 combined) on front slide which would not allow thread-rolling due to driving diameter.



Completed in one operation Too long to form complete. Stock diameter too large to use swing tools. Use of fourth slide for forming now permits part to be made in one operation.



Production increased 100% with carbide tools. Length restricts use of swing tool, and of wide form tool. Use of Fourth Slide frees upper rear slide for carbide breakdown of cut-off diameter.

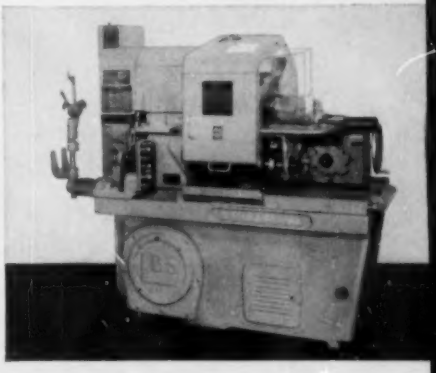
New Fourth Slide attachment permits up to 12 tools on B&S No. 2 Automatics – saves second operation costs

Now, still more of your screw machine jobs that formerly required expensive second operations can be machined complete from the bar. With the new Fourth Slide, and the 8-hole turret, the No. 2 Automatic can provide 12 cutting stations — four cross slide tools and eight end cutting tools. The main rear slide can now be used for extra operations, such as cross drilling or milling, thread-rolling, marking, or finish forming.

The Fourth Slide is located on the upper front of the machine at an angle. Two tool posts are provided, one for left-hand and one for right-hand turning. They can be interchanged with the upper rear slide post.

The three jobs shown in the drawings above are typical of thousands for which costs can be substantially reduced with the use of the new Fourth Slide. Production gains are as much as 100% or more.

The Fourth Slide is an optional attachment for B&S No. 2 Automatics now in production. Get complete information. Find out how the many new-design features and attachments now available can help you drive down production costs. B&S Machine Tool specialists will survey your operations at your request, and recommend new set-ups for savings. Write: Machine Tool Division, Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.



Brown & Sharpe PRECISION CENTER

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A "live" demonstration from Brown & Sharpe...

"Let me show how you can save milling machine - by using

...Mr. Kenneth E. Wood, Assistant to Manufacturing

"Your cutters last up to 3 times longer, held on B&S arbors. And the runout is as little as ⅛ the runout you get with other arbors—your accuracy up to 8 times better!

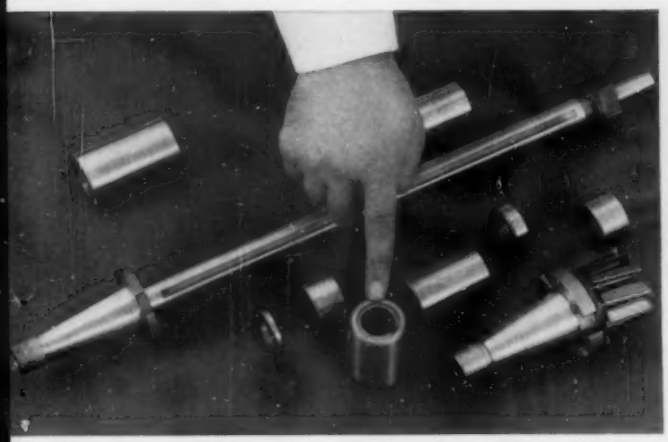
"Sounds hard to believe, but these are honest figures, taken from tests and records comparing Brown & Sharpe and competitive arbors.

"Milling machines are only as good as the arbors you put in them. Cutting tools are only as good as the arbors you use to turn them. You can preserve machine accuracy, extend cutter life and minimize work rejects by switching to better arbors.

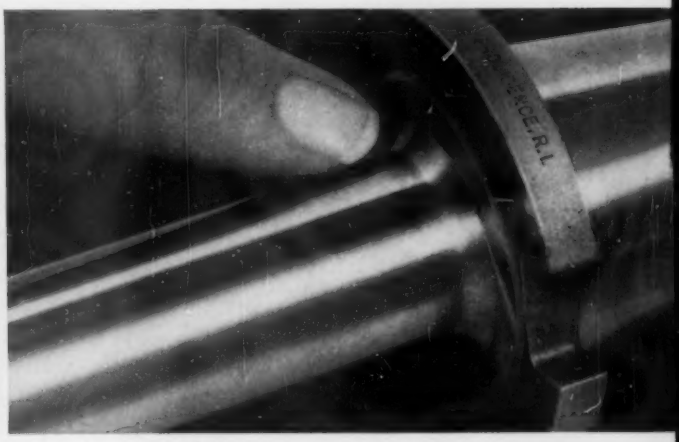
"Look at what you get in Brown & Sharpe arbors. I think you'll agree!

money in almost any make of Brown & Sharpe arbors"

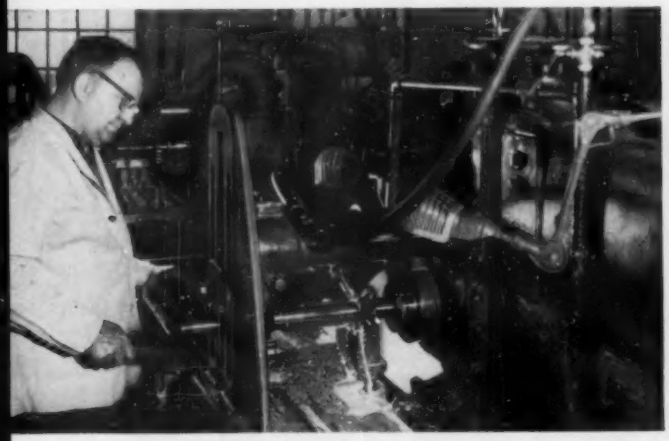
Manager, Industrial Products Division.



"See these faces? They're lapped parallel within .0001" (on Brown & Sharpe's 'Jo-Block' equipment!) Cutters centered by the collars and sleeves won't wobble . . . squareness of the shoulder flange is transmitted right down the line. The arbors are through hardened to approximately 200,000 psi — not just case hardened. All diameters and tapers are precision ground.



"You'll note there's a radius fillet where the shaft joins the shoulder, instead of a sharp corner. It reduces fatigue and flexing, by beefing up the arbor at its most critical point. The extra-fine finish on Brown & Sharpe arbors adds strength, too. Most arbor makers don't bother with these details, but when the chips start to fly, details can make a big difference to you!"



"No matter what makes of milling machine you use — on your production line or in your toolroom — you can usually get B&S arbors to fit them. Brown & Sharpe makes over ninety arbors, with Number 30, 40 and 50 Standard tapers as well as B&S taper shanks. This is the widest line offered by any machine tool builder — a better line backed by Brown & Sharpe's know-how in cutters *and* milling machines.

"For all this quality, you pay no more. That's the surprising part. Brown & Sharpe arbors are priced about the same as other widely used arbors — lower than those offered by other manufacturers of milling machines. You can buy B&S arbors 'bare' — or with collars and sleeves."

Ask your Brown & Sharpe distributor for "the arbors that save money!" **Brown & Sharpe Mfg. Co., Providence 1, R.I.**

Brown & Sharpe PRECISION CENTER

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Above: "Bridgeports" in the Mathewson Tool Co's. Shop, Orange, Conn.

Above: "M14 Springfield Rifle" (Official gun for Nato.")

"The Most for the Least"

Regardless of the size of your shop, be it large or small. Why not get all the facts concerning the "Bridgeport" and the many reasons why it is such a popular and profitable tool in the metal working market. Contact your nearest dealer or us direct for details.

The modern, highly efficient plant of the Mathewson Tool Company, Orange, Connecticut, is literally built around Bridgeport Millers.

The very first "M14 Springfield Rifle" (official gun for "Nato") was prototyped on Bridgeport Machines and according to Mr. Mathewson, President, "Our present 16 Bridgeports, with their precision, versatility and reasonable price helped us tremendously to build a modern and profitable business."

The experience at Mathewson Tool Company while most interesting, is by no means exclusive with this shop. It is, however, an outstanding example of what is being accomplished in metal working by Bridgeports and again points the way to lower costs and better profits through modernizing the "Bridgeport Way."

Bridgeport® MACHINES, INC.

Bridgeport, Connecticut

Manufacturers of High Speed Milling Attachments and Turret Milling Machines

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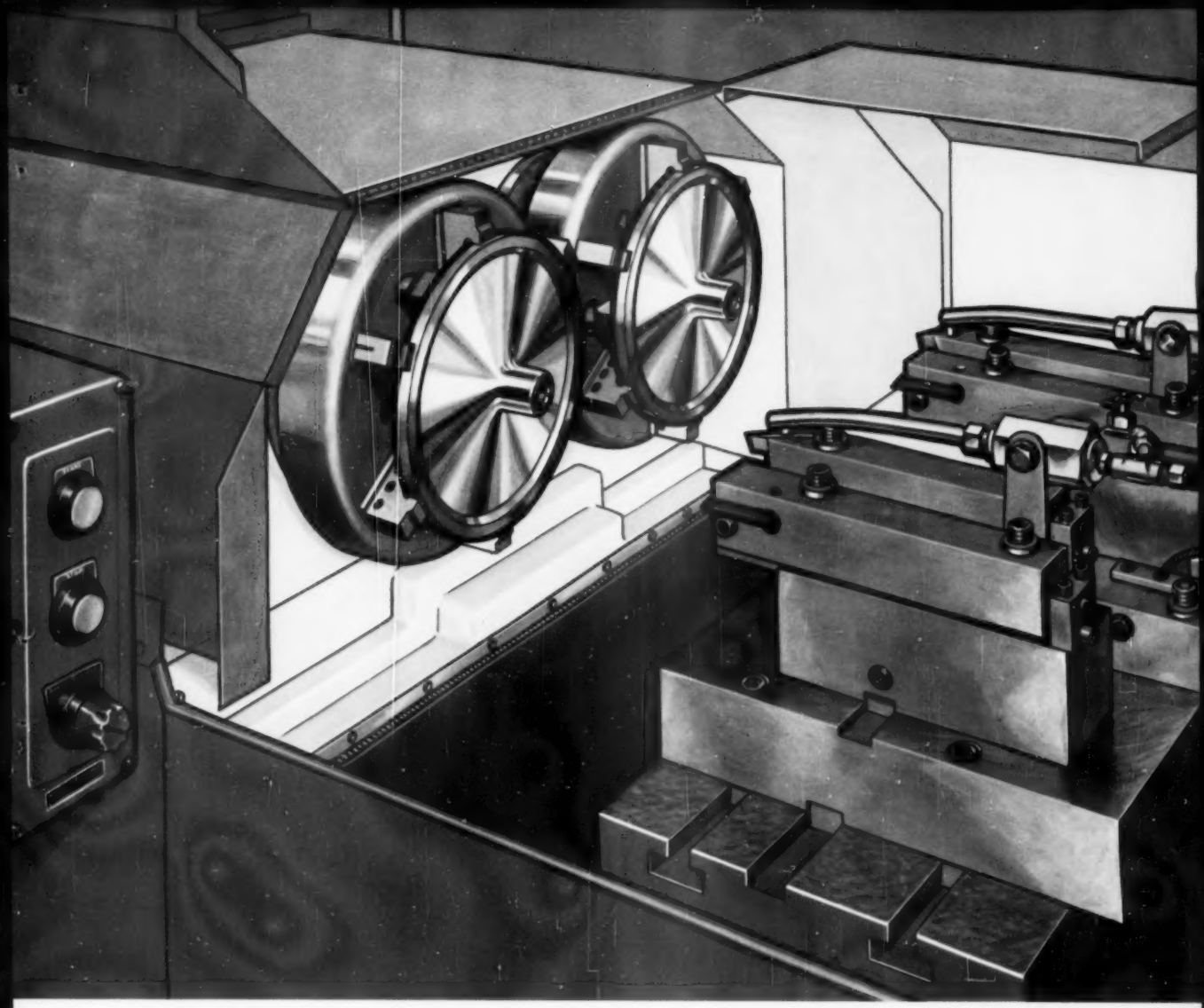
Use Reader Service Card, CIRCLE 51



New Britain cam actuated *boring and contour turning*

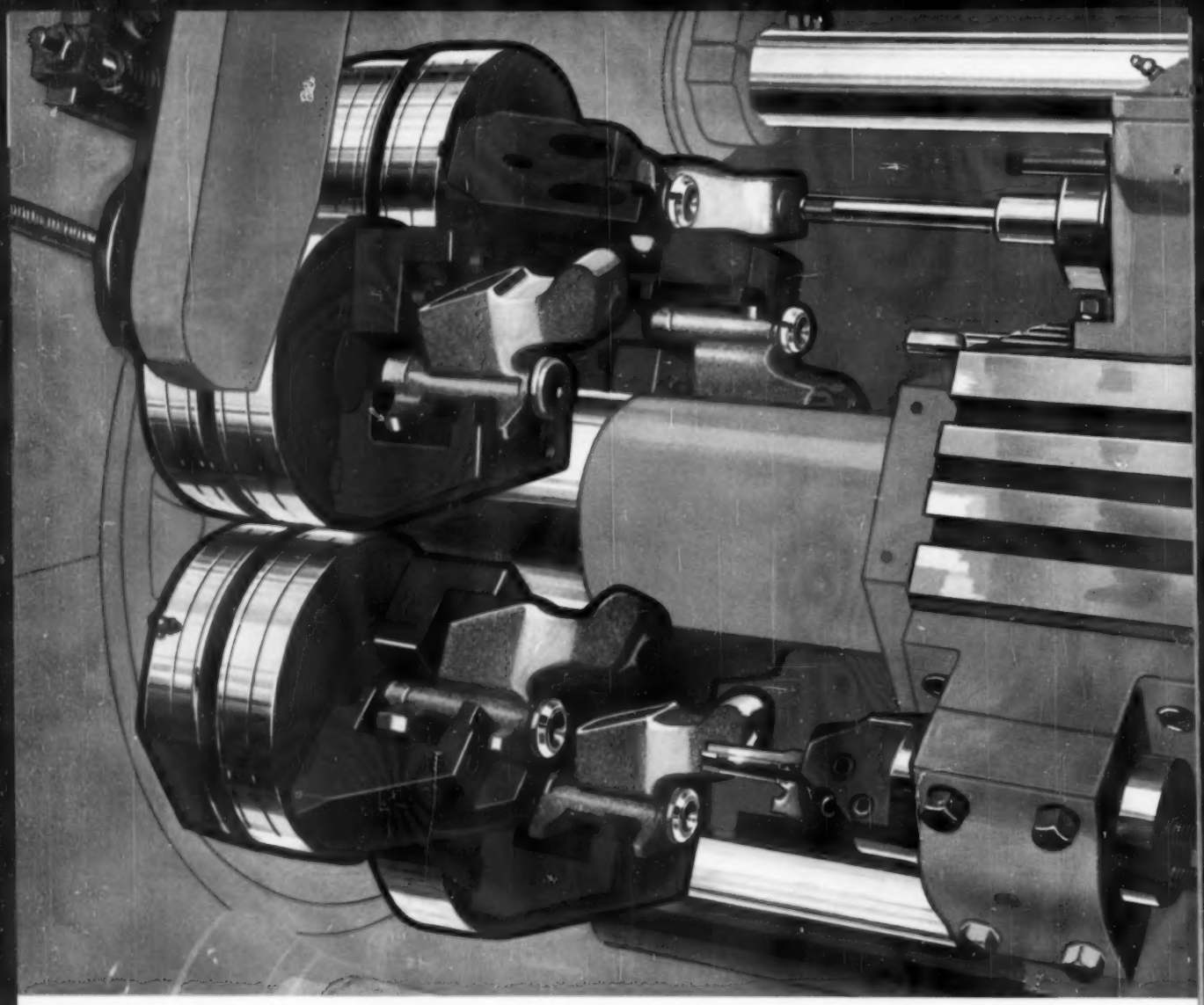
Extreme accuracy, high productivity—even on complex contoured surfaces—these are the areas where New Britain's Vertical and Horizontal Precision Contour Turning and Boring Machines take the kinks out of production. Tool slides are cam actuated, generating contoured and straight surfaces, including sharp corners and exact radii. Time consuming wheel forming and dressing required by some methods of producing close tolerance, fine finish work are eliminated.

This is basic with New Britain and is a good part of the reason for the unbeatable repetitive accuracy of these machines. Both verticals and horizontals are simple to operate and simple in operating principle. Normally, gaging one dimension is sufficient. From one to four high speed spindles can be mounted on a single machine.

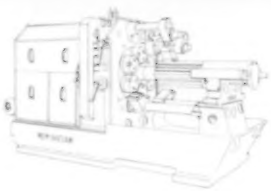
The widely accepted horizontals, or the completely new and revolutionary verticals with exclusive cam-in-head design, can be seen in action simply by contacting your New Britain representative. Whether you require one machine, several machines, the best approach to a building-block set-up, or whatever your precision contour turning or boring requirement may be, check with New Britain before you decide.

THE NEW BRITAIN MACHINE COMPANY

New Britain-Gridley Machine Division ◆ New Britain, Connecticut



Odd shapes no problem
on New Britain Chuckers



The peculiar problems presented by odd shaped pieces are frequently as varied as the pieces themselves. The cut may be simple enough but the how and wherefore of chucking and swinging the piece may be something else again. New Britain Chuckers can handle the widest possible range of pieces—even odd shaped work. Open-end design which allows wide open accessibility to the tooling area makes the work easier to chuck, and easier to watch during the machining cycle. Because the work area is more open, this kind of work is easier to swing on a New Britain. This is one of many extras that are built into New Britain Chuckers. Another basic New Britain difference that pays off handsomely is the exclusive forming arm design which allows for the greatest possible variety of side cuts without special set-up. The combinations of end-working and forming cuts possible are practically unlimited. This flexibility of tooling coupled with big capacity lets New Britain users perform the widest possible variety of chucking machine work. Why not call in your New Britain representative?

THE NEW BRITAIN MACHINE COMPANY
New Britain-Gridley Machine Division ◆ New Britain, Connecticut

Keeping Strong for Survival

Twenty years ago this month, the Japanese bombed Pearl Harbor. Since that time. America has been in a continuous state of hot war or cold war. During that period we have learned many things, not all of them to our liking.

We have learned that we must maintain a continual state of preparedness in order to insure our national survival. This preparedness means that we must have the latest weapons and the capability of producing them in quantity. Success depends, in large measure, on the ability of tool and manufacturing engineers to take the blueprints developed by the scientists and the product designer and translate them into reality for our armed forces in the shortest possible time.

The demand for ultraprecision manufacture and virtually 100 percent reliability of modern weapon systems calls for engineering talent of a high order. New machines, new processes, new production techniques have been called for and the tool and manufacturing engineers of this country have responded nobly. Unquestionably, America's production of advanced military hardware has served as a substantial deterrent to any nation that would like to start a hot war.

That is one of the reasons why our opponents have engaged in a cold war. If they cannot sink the American ship of state in a hot war, they will try to do so in an economic war. Through developing products that the world needs, manufacturing them efficiently and selling them at a low price, our opponents feel that they can weaken our country's economy, hence limit our capacity to wage any kind of war, cold or hot. Then they can control the world without firing a shot.

In this economic war, too, tool and manufacturing engineers are in the front lines. They, more than anyone else, are responsible for developing and applying more efficient manufacturing methods.

Your Society, by promoting efficient manufacturing, is an extremely active partner with the peoples and governments of the free world in their battle against those who would destroy freedom. Through research, through engineering education programs of all kinds, through the individual and collective efforts of its 41,000 members, ASTME is helping to show the world that a free economy is able to more than hold its own in any international struggle for survival.

Tool and manufacturing engineers are not only helping the free world keep strong, they are making it stronger every day. And, in the long run, that strength will prevail.

W. Moreland

PRESIDENT
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Quick guide to toolroom requirements

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Carbon Steel Drill Rod—A high-grade drill rod with smooth finish and extreme size accuracy.

Ry-Alloy® Drill Rod—Non-deforming . . . excellent finish, accurately sized, free from decarburization.

Ry-Alloy Ground Flat Stock—Accurately ground on all four sides. Ends and sides are square, parallel, and accurate to dimension. Free of surface decarburization . . . spheroidize-annealed for best machinability.

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Ry-Alloy Tool Steel—An oil-hardening steel. Combines high hardness and deep hardness penetration with minimum distortion, freedom from cracking. Good machinability.

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Carbon Steel Plate—All sizes and thicknesses.

E-Z-Cut® Plate—Remarkable free-machining qualities make this plate ideal for die bases, jigs, rubber molds, etc. Up to 30% savings in machining time compared to ordinary steel—with approximately 50% increase in tool life.

Complete heat-treating information is furnished with each shipment of Ryerson V.D. or Ry-Alloy Tool Steel.

ALLOY STEEL PLATE

4140 Plate—An oil-hardening, annealed plate of firebox quality. Specially developed for maximum strength and uniform hardenability throughout the cross section. Thicknesses from ¼″ through 5″.

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Cold Finished Bars—A wide range of analyses. Rounds to 10″; squares to 4″; flats to 12″ x 2″.

Stripper Plate—Both surfaces ground and polished to a thickness tolerance of plus or minus .003″. Edges planed instead of sheared or rolled, insuring parallel sides free from strains. Warping and distortion after machining practically eliminated.

Aluminum Tooling Plate—Reynolds Type 33 wrought plate and Pioneer Type 921-T-DC cast plate.

Whatever your requirements, contact your Ryerson representative for widest selection, highest quality, fastest shipment, complete satisfaction.

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how computers solve planning problems

You don't have to be a mathematical whiz to put a computer to work on production planning problems. General Electric Co is teaching its manufacturing engineers all they need to know about computer simulation of production lines—an important new technique that may save American industry millions of dollars yearly—in just four days of intensive training.

By J. E. McCombie
Factory Systems Design Engineer
Advanced Manufacturing Engineering Service
General Electric Co.
Schenectady, N. Y.

MODERN, high-speed digital computers have become important tools for tool and manufacturing engineers. Their use in developing machining programs for numerically controlled machine tools is well-known. Not so well-known is the fact that computers are being used in planning.

When engineers are planning a production system, the question that is uppermost in their minds is, "How will it work when it is in actual operation?" In multioperation production lines, there's always a chance that potential bottlenecks will be

Results of Manusim Case Study

Name of Team	Machine Utilization (percent)	Labor Utilization (percent)	On-Time Job Completions (percent)	Total Floor Space (square feet)	Number of Machines	Additional Investment (dollars)	Cost of Floor Space* (dollars)	Labor Cost* (dollars)	Inventory Cost* (dollars)
Alpha	96	97	7	3100	28	100,000	120,000	1,170,000	131,000
Beta	54	96	37	4331	43	500,000	150,000	1,950,000	98,000
Gamma	88	91	98	2220	39	745,000	88,000	1,890,000	37,000
Delta	94	99	81	2915	37	690,000	110,500	1,750,000	49,500

*For first year

overlooked, leading to costly delays on the production floor. And the possibility of a new production line not performing as anticipated increases as the number of operations in the line increases.

For years, manufacturing engineers have been looking for a quick and easy way to try out planned production lines before machines and tools are installed. Working with paper, pencil and desk calculator, it is possible to get a pretty good idea of potential performance, but where there are many variables—and this is true of just about any full-scale production system—there's been no way to effectively try out a manufacturing line short of actually installing it and operating it under normal production conditions.

Almost every company has had experiences with new production systems that, despite careful planning, didn't reach planned output until costly and time-consuming modifications were made.

Computers End Bottlenecks

Now, with the advent of large computers, manufacturing engineers have a sure-fire way of determining whether their planning effort has been fully effective. With a computer, the operation of a planned production line can be simulated. In just a few minutes of computer time, the results of months of actual operation can be determined. Bottlenecks and other sources of troubles can be identified and the actual output of the line over a period of time can be checked. Alternative plans can be tested and the best plan chosen.

General Electric Co. has been one of the leaders in applying computer simulation techniques to manufacturing planning. (See THE TOOL AND MANUFACTURING ENGINEER, February 1961, p. 71.) After several years of experience with this new technique, GE management is confident of large dollar savings by applying it to manufacturing planning for products as different as household toasters and complex military electronic devices.

Originally, computer simulation was the province of a few company specialists, aided by outside experts. Today, however, the company is successfully teaching the application of computer simulation to hundreds of its manufacturing engineers, during the course of four-day do-it-yourself workshop sessions.

The workshop sessions are conducted in company plants. The participants—engineers who have considerable skill and experience in manufacturing and manufacturing planning—are divided into teams. Each team is given information on a hypothetical planning problem and is given 90 minutes to come up with a solution—a solution that is tried out on a computer.

The 90-minute problem-solving session is, of course, too short to study the problem in depth, but

DEEP IN THOUGHT. Manufacturing engineers have 90 minutes to develop a solution to a hypothetical manufacturing problem. Their answers will be tried out on a computer that simulates actual plant operation.

HOW DID IT WORK? **Participants in workshop session wait for the computer solution to a hypothetical manufacturing problem.**

it does give the teams plenty of time to develop a reasonable production plan on the basis of the data given. Essentially, the teams get a quick, do-it-yourself demonstration of the use of a computer as an aid in planning. The computer doesn't modify the planned production line in any way, nor does it say that any one plan is best—engineering judgment is needed to make that decision. But since the computer tries out each plan and shows how that plan would work in production, it often makes the decision between various plans an easy one.

Hypothetical Problem Solved

A typical problem given to a recent workshop session deals with a hypothetical Manusim Department in a hypothetical company called Universal Power Co., Inc. "Manusims" are power and gear units that are installed in many different kinds of industrial machines. Sales are good and future sales look even better.

By way of background, the workshop participants are told that management has decided to move the Manusim Department to another city, where it will be housed in a new plant. At present, the department operates in an old, high-bay wooden structure. Operations are hampered by inadequate floor space for production and storage. The department has a poor record of meeting delivery promises made to customers and the movement of orders through the plant is slow.

This background information highlights two requirements that must be met in planning the new plant—it must be capable of making deliveries on schedule and orders must be filled in less time.

As part of the problem, workshop participants must choose between various dispatch rules. One of these rules could, possibly, result in more effective operation in the new plant. The rules are: first come, first served; first come, first served within priority classes; sequential priority based on value; minimum immediate processing time; maximum immediate processing time; earliest starting date.

Participants are told that the new plant should have five percent greater productivity than the existing plant. Since a minimum of capital is available for investment purposes, no extra space or machines above immediately anticipated requirements will be approved.

Each team is also given data on product order mix, order routing, floor space, number of machines required and their replacement cost, number of employees, production costs, and similar information.

With the pertinent data in hand, each team plans a production system that it thinks will attain the required objectives.

Results of planning by four teams who participated in a recent workshop session are shown on the accompanying chart. It is apparent that only the "Gamma" team was able to really solve the problem of on-time deliveries in the Manusim Department. Ninety-eight percent of its orders would be completed on time, as compared to seven percent with the system devised by the "Alpha" team.

Each plan looked good to the team that developed it, but only one plan would have given good results in production. With more time for study, the teams probably would have come up with better answers to the "Manusim" problem, but that's not the objective of the workshop sessions.

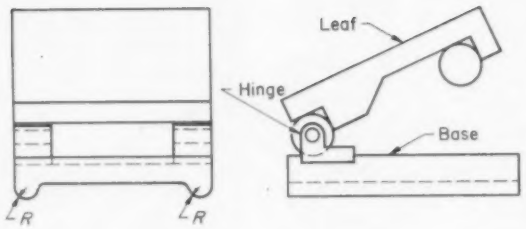
The "right" answer that all participants take away with them is the fact that a computer can be a really helpful tool in manufacturing planning—and that it is a tool that they, personally, can put to work in their own plants.

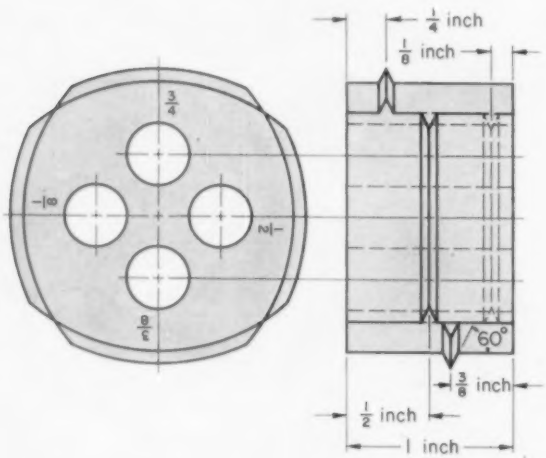
Gadgets — Ingenious Devices And Ideas

Sine Plate Grinds Compound Angles

Designed for grinding compound angles, this tool has a base that makes it a two-in-one sine plate. One angle is obtained by elevating one edge of the base to requisite height: the other is obtained by elevating the leaf. Principal advantage of this tool is the ability it provides to grind both right and left-hand compound angles.

Robert Daniels, Chicago, Ill.





Special Gage Speeds Surface Plate Layout

Gages of this type are handy tools in scribing lines of nominal height in surface plate layout work. The gage is of hardened and ground tool steel. Cutting edges are machine ground from four equally spaced holes. Heights of the cutting edges stamped in the end surfaces facilitate selection of the correct scribing edge.

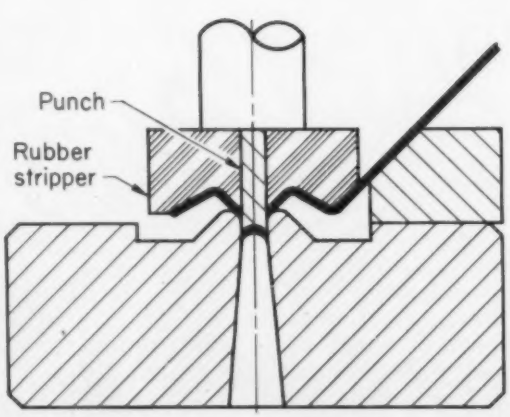
Allen O. Shively
Elkhart, Ind.

Radial Piercing Punch Eliminates Hole Distortion

Holes pierced in sheet metal at bend lines are invariably distorted when bending takes place. One way to eliminate this distortion is to make piercing a secondary operation, using punches and dies of the type illustrated. The die—similar in design to that of a press brake die—supports the workpiece on both sides of the bend. Clearance cut on both sides provides room for secondary bends.

The punch is designed with a concave radius equal in size to the radius of the bend, allowing a uniform cutting action which would be impossible to effect with a conventional flat punch. Stripping of the punch after piercing is accomplished with a rubber pad secured to the punch holder.

A. C. Guglielmi
Watertown, Mass.



GADGETS CONTEST

Send In Your Entry Now!!!

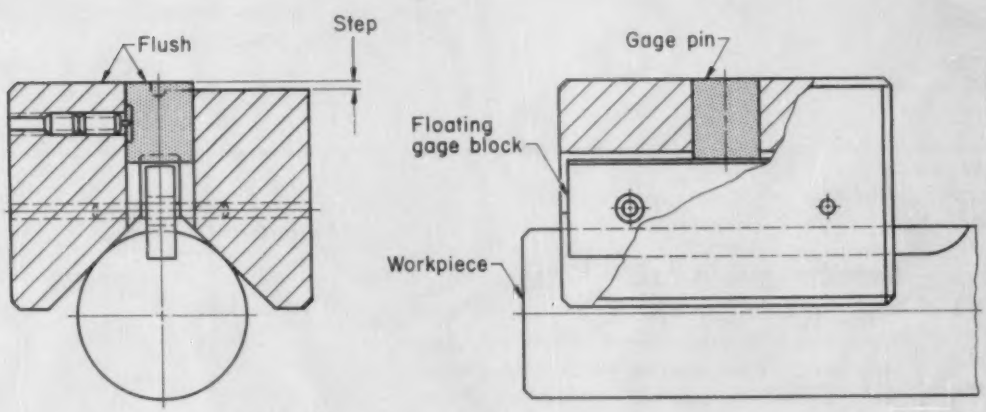
The Gadgets Contest is going strong. Be sure to take advantage of the opportunities it presents—to win a prize, to be paid an honorarium and to have your pet ideas published in the pages of THE TOOL AND MANUFACTURING ENGINEER.

Entering the contest is simple. Send us a brief description of your idea accompanied by a photograph or line drawing. Don't worry about the quality of your drawing or the polish on your prose. It's the idea that counts.

Here are the contest rules:

- Contest is open to ASTME members only
- Entries must be limited to 500 words
- Sketches in lieu of finished drawings are acceptable
- Entries will be judged by the ASTME Editorial Committee on the basis of originality, conciseness and clearness of presentation
- Prizes: First prize, $100; two second prizes, $50; four third prizes of $25; and honorable mention awards to all close runners-up.

Don't forget . . . the contest closes December 31. Rush your entries now to THE TOOL AND MANUFACTURING ENGINEER, 10700 Puritan Ave., Detroit 38.



Flush Pin Gage For Inspecting Key Slots

Designed for inspecting key slot depths in cylindrical parts, this gage consists of a V-block base, floating block and stepped gage pin. In use, its action is essentially that of a conventional flush-pin gage. When moved on a workpiece, the gage should be rocked slightly to insure correct alignment to the axis of the part.

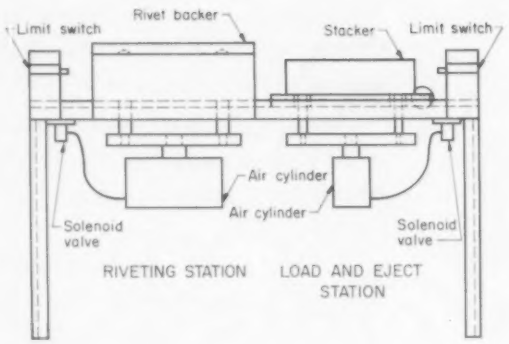
E. W. Swanson, Jr.
San Jose, Calif.

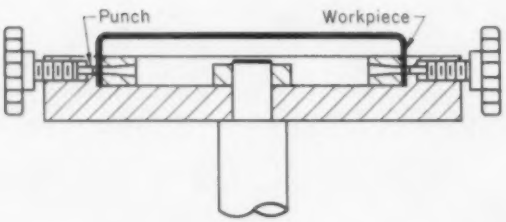
Gadgets

Machine Speeds Assembly of Lamination Stacks

Designed and built to expedite the riveting of lamination stacks, this device can assemble various types of laminations by simple rearrangement of the punches. In operation, rivets are inserted in the lamination stacks which are then loaded into the stacker unit. The stacker—moved manually to the left—contacts a precision limit switch that actuates a solenoid valve that feeds an air cylinder. The cylinder performs the staking operation by elevating a punch assembly that stakes the prepositioned rivets. At this point manual movement of the stacker to the right actuates a similar electrical-pneumatic sequence. Part ejection is effected with an air cylinder actuated by a limit switch.

John J. Picot
Granby, P. Q.





Threaded Piercing Punches Cut Tooling Costs

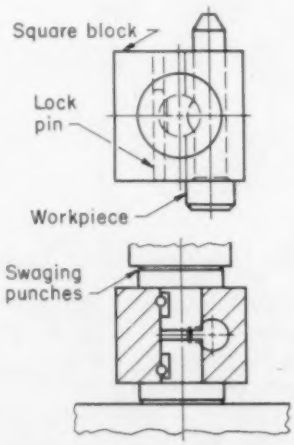
Hole-piercing costs in short-run production can be reduced by using piercing fixtures instead of piercing dies. As shown in this illustration, piercing is effected by a threaded punch which is actuated by a hand knob. This is an effective and inexpensive substitute for the cam-piercing punches normally used for parts of this design.

Clint McLaughlin
Rockaway, Queens, N. Y.

Keys Swaged in Arbor Press

Integral key swaging operations can be effectively done in an arbor press with this tool. Basic components are two swaging punches and a square block in which the punches are mounted. In use, the workpiece is inserted in the block and the swaging punches are activated by the arbor press ram. Throughout the operation, stability of the tool is maintained by the excessively large heads on the punches.

M. W. Loftus
Chicago, Ill.



conveyor speeds JOB SHOP BRAZING

By D. H. Neudorfer
Power Circuit Breaker Dept.
Westinghouse Electric Corp.
Trafford, Pa.

Brazing of dissimilar parts in small-lot quantities is usually a bottleneck in the over-all production flow. This article tells how Westinghouse broke the bottleneck by designing and building a conveyor line that puts each brazing job on a semiautomatic basis.

DEVELOPMENT of automatic and semiautomatic production equipment is, in many cases, the result of the natural evolution of a production process. In others it is the inevitable consequence of changes within the corporate structure of a manufacturing complex. A good example of the latter is seen in the manufacture of power circuit breakers at the Westinghouse Corp.'s Trafford, Pa., plant. In 1957 Westinghouse decided to establish a power circuit breaker department as one of a number of self-sustaining profit centers. This center was to have responsibility for the manufacture of virtually all the components it used. This meant that the circuit breaker department would no longer be able to use the brazing facilities of other departments and that the development of new methods of brazing was imperative, *Fig.* 1.

Development of Facility: After a study of all brazed joints had been made in the company laboratory, it was recommended that a conveyor type

Fig. 1. Multistation brazing machine in operation. Workpiece rotation at this station lessens the need for exact burner pattern normally required.

facility be made for the brazing operations. This line was to have three branch lines, each of which was to serve different types of assemblies. Some of the brazing operations were to be performed manually and others by machine. Machine brazing would be accomplished on a 10 kc induction machine, a single-station and a multiple-station Selas machine. Because the induction machine would be serving a wide variety of parts, the planning group in charge of the operation was confronted with a second problem—the development of a multipurpose induction heating coil.

Past research at Westinghouse had disclosed that the use of sintered powdered iron in induction coils was highly practical. Initially, these coils were used in the progressive heating of structural steel members. Success in this application led to the development of a split coil, each half of which contained a sintered powdered iron core. Because the projected brazing facility was conceived as a tool for accomplishing work in job shop lots, it was decided that the split coil came closest to satisfying all requirements. An evaluation of its use showed lower efficiency than that of coils designed for specific assemblies but these losses were compensated for by reduced expenditures and minimized coil-change time.

While the laboratory was making its study of coils, the facilities planning committee was working on the design of the brazing installation. In making the layout the committee worked from two premises—that a brazing installation must be supplied with clean parts if it is to produce high-quality assemblies; and that processing must be completed in less than 24 hours after cleaning.

After a number of possibilities were proposed, discussed and rejected, the committee reached final agreement on the installation shown in *Fig.* 2. In this layout individual components are conveyor-fed by basket from a parts storeroom to a wash, pickle and bright bath machine according to directions issued by the area foreman. The bright dip machine picks up the baskets, indexes them through

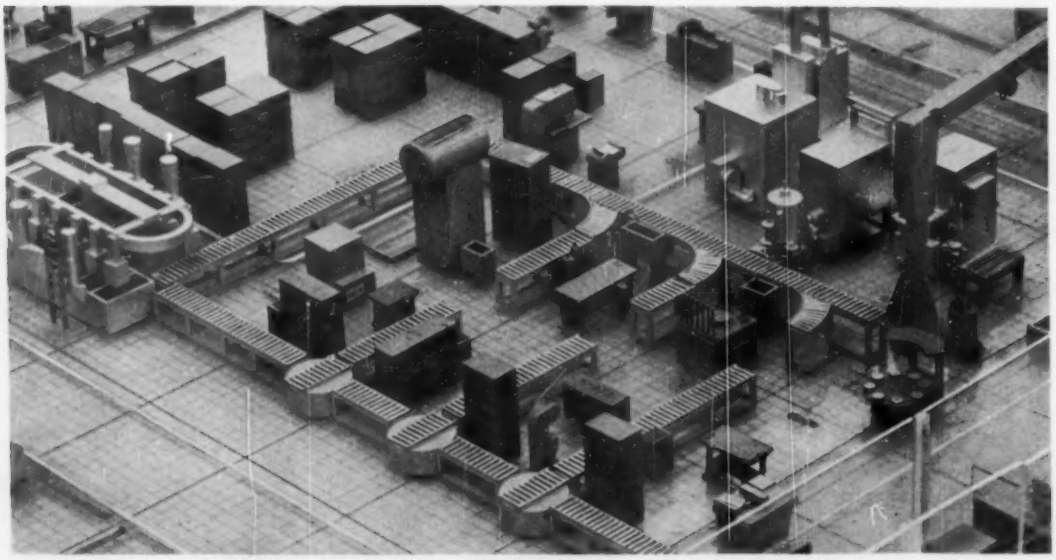


Fig. 2. Three-dimensional model of the line. Bright dip tank is seen at left, jib crane at right.

the various cleaning stages and discharges them to a straight-line roller conveyor. This machine is served by one operator whose duties include the maintenance of solutions at proper levels of strength, the matching of parts and identity cards according to operational sequence, and the movement of baskets from the straight-line conveyor to one of the three branch conveyors. Basket transfer to the branch lines is accomplished with turntable stations to eliminate crane or fork truck transport.

Line Operation: The first branch line transports parts to the induction brazing operator. Parts normally presented to this station are Cupaloy, silver and copper-tungsten alloys in which contact of the tip and joint must be of the highest possible quality. In addition, the reduction of hardness of the Cupaloy contact itself must be limited to a carefully controlled minimum.

After brazing, the assemblies are placed in baskets on another roller conveyor line which returns them through the storeroom fence to the loading station of the bright dip machine. This trip—the second through the bright dip machine—removes all fluxes and oxides resulting from the brazing operation. At the completion of the bright dip operation the parts are discharged onto the straight-line conveyor for routing through an inspection station. At this point the joints are inspected by either ultrasonic Reflectoscope or maximum mechanical loading in shear. In addition, Brinell hardness readings are taken at a fixed distance from the joint and many of the parts are fluorescent-penetrant tested. After inspection, the parts are moved to the assembly storerooms.

The second branch conveyor line transports the parts to a single-station brazing machine, *Fig.* 3. Because of their material or size the parts cannot be handled in the first line and they are too few in number to be set up for the multistation machine in the third line. This station is designed for quick-change burner patterns and for the withdrawal and presenting of this pattern to subsequent assemblies. As in the first line, the parts are routed to bright dip, inspection and storage after brazing.

The third branch conveyor line supplies the multistation automatic turntable machine and the oxyacetylene manual torch operators. The multistation machine, *Fig.* 1, handles various sizes and types of solder seal condenser bushing flanges—parts that have comparatively high production activity. This type of assembly consists of a wrought brass tube, a cast brass flange and a drawn copper diaphragm. The operator fluxes parts, assembles them, preplaces brazing alloy rings and mounts the prepared assemblies on rotating stations on the main rotating table. Four of these stations are idle to provide the operator with additional time for handling difficult or "cranky" assemblies. Beyond the idle stations the parts enter preheat stations where they are rotated within the burner pattern. The final braze station immediately precedes the unload station, a position that enables the operator to give the part a final visual inspection and add additional brazing alloy if required. The flanges brazed in this station are cleaned in the same manner as the other assemblies, after which they are rerouted to a spur line. At this point the diaphragms are tinned while rotating in a horizontal position.

Beyond the multistation machine, the conveyor

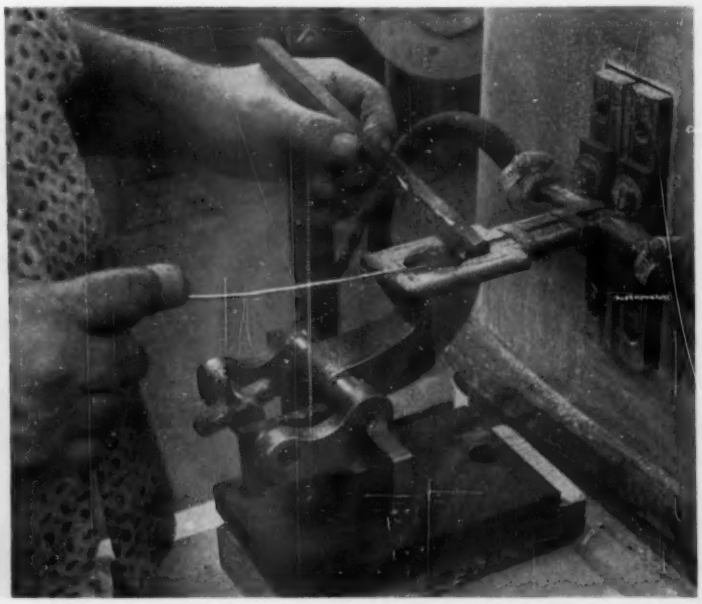


Fig. 3. Single-station induction machine. Coil is bringing Cupaloy rocker arm and silver-tungsten contact to brazing temperature.

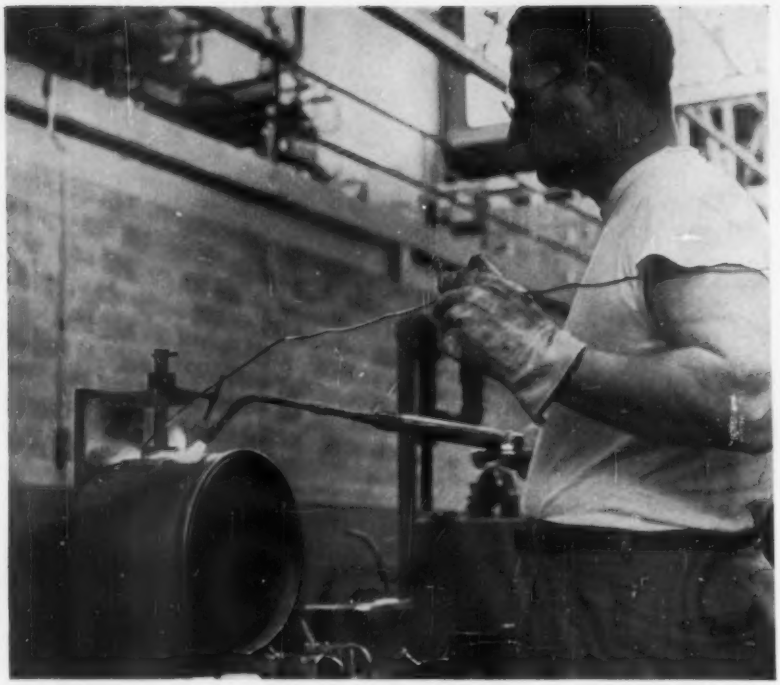


Fig. 4. Hand brazing in three planes. On this part localized heating was selected to eliminate need for bright dip between brazes.

presents parts to the oxacetylene operators, *Fig.* 4. These parts are either massive single assemblies or complex piping arrangements. If they are of the massive variety they are preheated in an open furnace. After fluxing and preheating, the operator handling the job summons a second operator to assist in the application of final heating and brazing. If the assemblies are piping arrangements, they go to an operator further along the line who aligns and clamps the components with angle plates and surface plates. After completion of brazing, the parts are returned to the conveyor with a jib type crane. As with the other assemblies these parts are returned by conveyor to the bright dip machine for removal of fluxes and oxides.

Some of the assemblies are brazed on a resistance brazing machine some 15 feet from the conveyor. Assemblies routed to this machine are stored on a short section of the straight-line conveyor while waiting transport. The assembly normally brazed at this machine is a two-part stationary contact consisting of two brass castings. These castings have silver or copper-tungsten contact tips which are joined to each other with a multileaf shunt. The shunt has solder solidified at both ends. All operations involved—preparation, solidification and forming of the shunts, and reveting to the previously brazed contact body—are accomplished in this area. At the completion of assembly, the parts are returned to the conveyor for transport to the cleaning and storage areas.

In actual production the conveyorized line has not proved an unmixed blessing—nor can it as long as part design is in a constant state of change and production requirements remain relatively low. It has demonstrated, however, that job shop brazing operations can be accomplished on a semiautomatic basis with a minimum of operator control.

Research Dollars on Upswing

Research spending in the United States in 1962 will amount to almost $16,000,000,000, predicts Battelle Memorial Institute economist George W. James. By comparison, research spending totaled $14,000,000,000 in 1960 and $3,000,000,000 in 1950. James estimates that the government will spend $10,000,000,000 for research next year, reflecting stepped up space and defense programs. Industrial research will approximate $5,500,000,000 and that of universities and foundations $350,000,000. To forecast industrial research spending, James used a new method based on cash flow instead of surveys of industry spending plans. His prediction of government spending is based on a composite of appropriations, obligations, commitments and policy changes.

rivets hold cost line in electrical manufacturing

Because they lend themselves to mechanized assembly operations and because they are extremely reliable in service, rivets are finding wide application in electrical and electronics industries.

Rivets are being used to join components of missile guidance systems, electrical circuitry and modern communications equipment. There are several reasons for this.

Riveted joints, when properly designed and applied, remain tight under severe usage. There are many ways in which rivets can be modified to increase their holding power for extreme service conditions. For instance, the undersides of heads can be serrated to increase torque resistance or parts can be notched and interlocked when riveted. Often, special rivets can be developed to improve joint quality without adding to manufacturing costs.

Riveting is, in many ways, an excellent fastening method so far as manufacturing engineers are concerned. Rivet setting machines are efficient and can usually be changed over for different jobs with a minimum of time and retooling. Automatic hopper feed mechanisms and automatic cycling mechanisms make it possible to automate riveting operations at comparatively low cost.

The fact that riveting can be used to join dissimilar materials using routine procedures also simplifies the manufacturing engineer's job. Making metal-to-plastic joints presents no problems. The same riveting procedures and equipment used for metal-to-metal assembly are applicable for plastic-to-metal fastening.

A typical product that is assembled by riveting is the variable resistor shown in *Fig.* 1. This resistor has a phenolic plastic core that measures 0.028 inch thick by 0.375 inch wide. Length of the core depends on the resistance rating desired. Except for small areas at each end, the strip is coated with a zinc compound and wrapped with fine wire. Both ends are pierced so terminals can be attached by riveting. Diameter of the holes is 0.093 inch; rivet shank diameter is 0.085-0.088 inch. The underside of the oval heads of the rivets is serrated for better resistance to torque.

Rivet tightness is imperative. If the joint loosens in the field, resistance falls off, circuitry is upset and electrical malfunctions result.

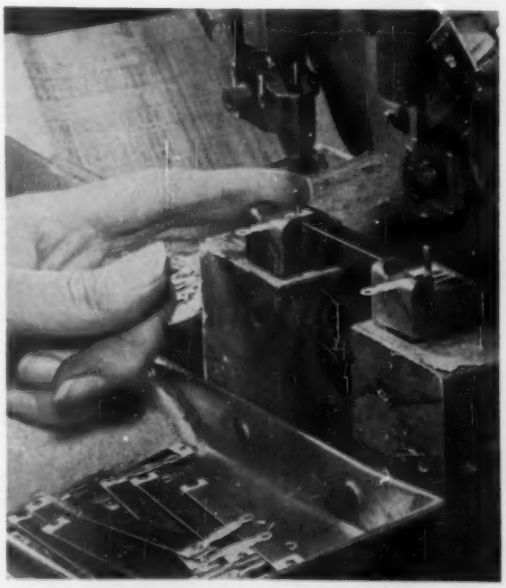


Fig. 1. Adjustable-center riveting machine fastens terminals to both ends of variable resistor strip in one operation. Rivets are automatically fed into position.

The distance between the rivets varies with resistor capacity, ranging from 1 to 2½ inches. This warrants the use of adjustable-center riveting machines. Each riveting head has its own side-mounted automatic rivet feed mechanism. Fixturing consists of two blocks, each having a spring-loaded anvil with a machined recess to accommodate the connector. The operator hangs the connector over the guide pins so they rest in the recess, adds the phenolic winding strip and traps the machine.

Fixturing for single-spindle setting machines usually follows a few basic designs. In assembling the resistor shown in *Fig.* 2, a ring-shaped plastic base, 1 $^{11}/_{16}$ inches in diameter and $^{5}/_{8}$ inch deep is fitted with a gold-plated brass collector ring and center terminal. The collector ring segment butts against an embossment in the circular base. A molded projection in the base keeps it from shifting.

Mounted to the side of the anvil post is a hob-shaped fixture containing the anvil and guide pin. The machine operator hangs a washer on the guide pin, locates the collector terminal in the base, nests the parts on the hub and triggers the setting machine. The rivet—a brass, nickel-plated, semitubular design with a shank diameter of 0.118-0.123 inch—is clinched against the washer.

Many types of resistors have plastic components that have low resistance to impact. With a few simple precautions, cracking or shattering of the plastic during rivet setting can be avoided. The resistor shown in *Fig.* 3 has a molded plastic base with a rimmed edge about 0.125 inch high. A copper core is cemented into the base. A brass terminal is attached to each end of the core and is riveted to a ledge molded as part of the base.

Flat-head semitubular rivets are driven through countersunk holes and clinched. Shank diameter of the rivets is 0.060-0.058 inches; length is 0.130-0.140 inch. The rivets are waxed to facilitate automatic feeding.

A single-spindle rivet setting machine is used. The machine is equipped with a pneumatic anvil that absorbs impact and compensates for variations in the thickness of plastic. A hub and a projection in the plastic case fit into machined depressions in the fixture. Rivet holes are aligned by a guide pin in the anvil.

These examples demonstrate the merits of riveting from a manufacturing point of view. And, with new assembly problems coming along daily, tool and manufacturing engineers are finding, more often than not, that this old process lends itself to applications on new products.

Acknowledgment. Information for this article was gathered by the Tubular and Split Rivet Council. The riveting operations described are performed at Clarostat Manufacturing Company, Inc.

Fig. 2. (above) Collector ring and center terminal are riveted to the rim of the plastic base of a variable resistor.

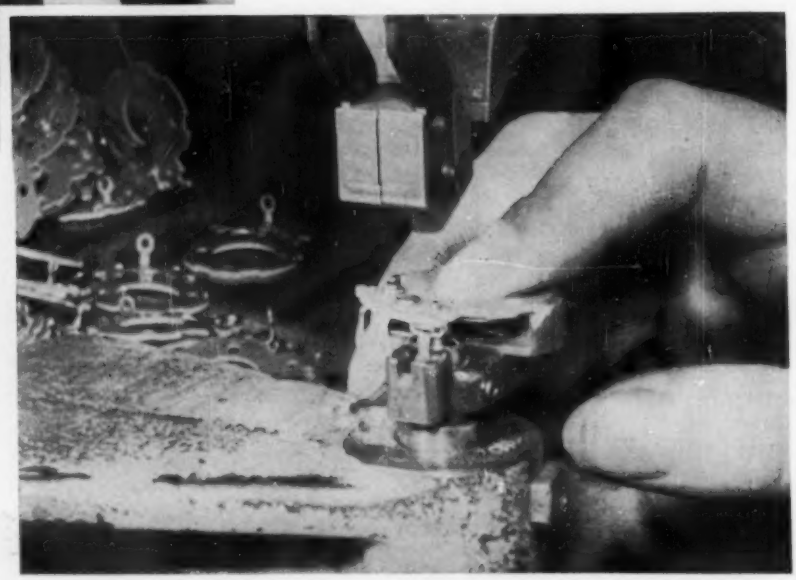


Fig. 3. (right) Pneumatic anvil prevents the phenolic base of this resistor from shattering when riveting is performed.

designed for
PRODUCTION

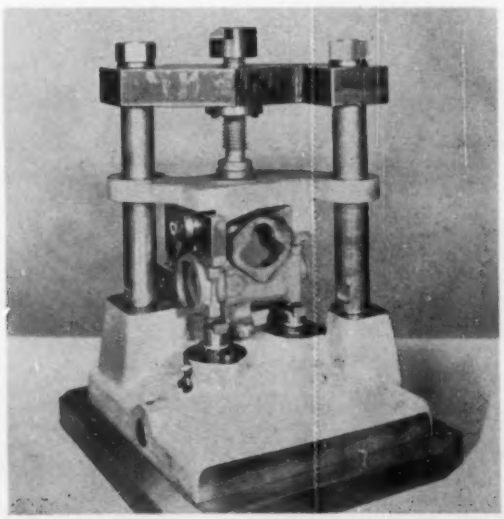
Pallet Increases Transfer Line Flexibility

Through use of specially designed pallets, the transfer line illustrated performs all machining and assembly operations on gear housings in one setup. The pallets are of open design to permit machining and assembly on all sides of the castings. Because the accuracy of any given operation is dependent on workpiece positioning, the pallets must be machined to tolerances closer than those of the part itself.

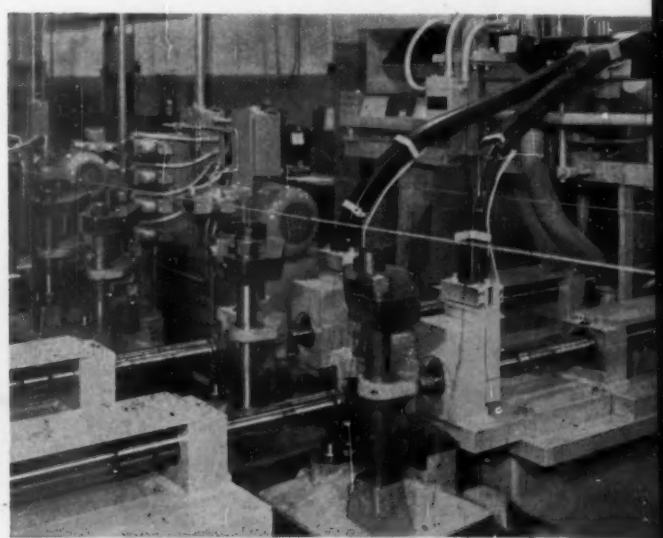
Alignment of the workpiece in the pallet is accomplished with a pneumatic pusher. While the pusher positions the casting against stop blocks, an electrically powered wrench tightens the clamping nut. Clamping is similar to that of a vise in that a movable jaw, positioned in relation to the workpiece by guide pins, actuated by a leadscrew.

Each station in this line, designed by The Cross Co., is designed to perform double duty in that two machining units are utilized and two pallets are accepted. In this way two finished parts are produced for every cycle of the machine.

Inclusion of an assembly station in this machining line increases the line's efficiency significantly. In this station pitman shaft bushings are pressed into previously machined holes. As the cycle begins, backup units feed out to support the workpiece. If either position has not received a part, a probe in the backup unit senses the absence and deactivates the assembly tool. If a part is present the assembly tool picks up a bushing and advances, pressing the bushing into the machined hole. Protection against assembly of oversize bushings is insured by a gaging device in the parts feeder.



PALLET for part fixturing during transfer operations. Guide-pin positions permit entry of machining and assembly tools from all sides of the castings.



PARTIAL VIEW of the line. In this station, bushings are pressed into castings by horizontal cylinders in background. Cylinders in foreground support castings during assembly.

DESIGNED FOR PRODUCTION

Computer Monitors and Controls Production Line

Missiles and space vehicles contain thousands of electrical resistors, any one of which could cause in-flight failure. The problems of increasing reliability while simultaneously meeting increased demand for the resistors have been solved at Western Electric's Winston-Salem plant by installation of an automated production line. Reliability of finished parts is assured by a general-purpose computer that controls each of the individual stations in the line through continuous feedback loops.

Two of the stations in the line are of special interest. The first is a terminating station that deposits a layer of gold at each end of the resistor. This operation takes place in a 36-station circular indexing machine in which masked resistors are loaded into bell jars. As the jars index, they are evacuated and refilled with argon gas at low pressure to provide an inert atmosphere for sputtering by a good cathode. The deposit obtained in this operation is approximately 0.000010 inch thick and requires nearly a minute to accomplish. After it has been completed, the jars continue to index until they arrive at the unload station at which point the workpiece is returned to the transfer line for movement to subsequent stations.

The second outstanding operation involves the use of a printing machine for marking finished resistors according to wattage, resistance value, production lot number and date of completion. This machine—a modified offset press—has a blanket

INDEXING MACHINE for gold sputtering of resistor terminals. Engineer is holding bell jar in which deposition takes place.

PLANETARY gear mechanism for offset printing of the resistors. Parts advance through this station on the track beneath the head.

roll and inking rolls mounted on a planetary gear mechanism. Unlike a conventional offset press, this machine has a stationary head, an arrangement that permits the addition of servo drives for automatic changing of type. Controlled by the computer, the servo drives can set type for from one to 45 different code numbers with over a million and a half permutations of code and resistance value combinations.

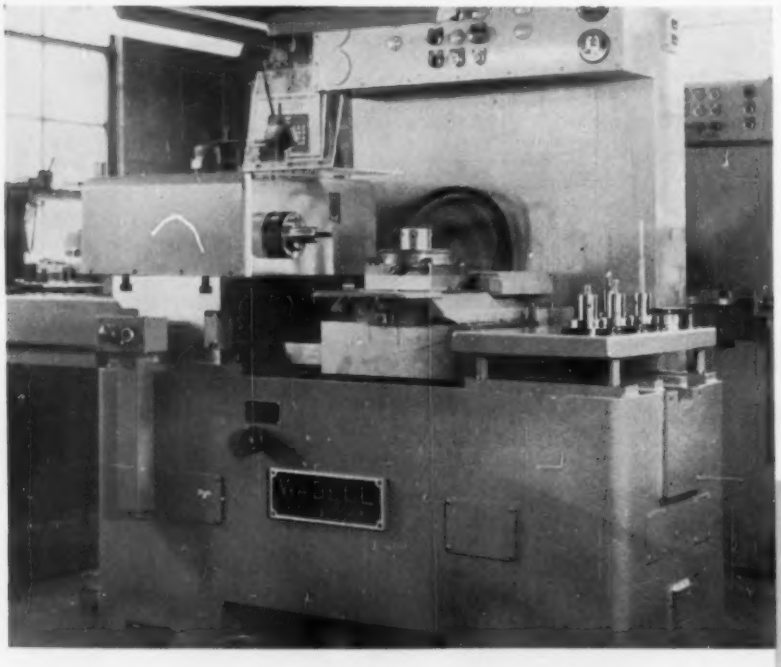
Heart of this production line is the computer. Equipped with a 4096 word memory drum, it performs in three critical areas of production. It programs production control, analyzes quality with the methods of statistical quality control, and detects and corrects any drift from predetermined manufacturing tolerances.

INTEGRAL PART of the line is this general-purpose computer. Special input and output circuitry was designed for programming, setup and feedback control of each station.

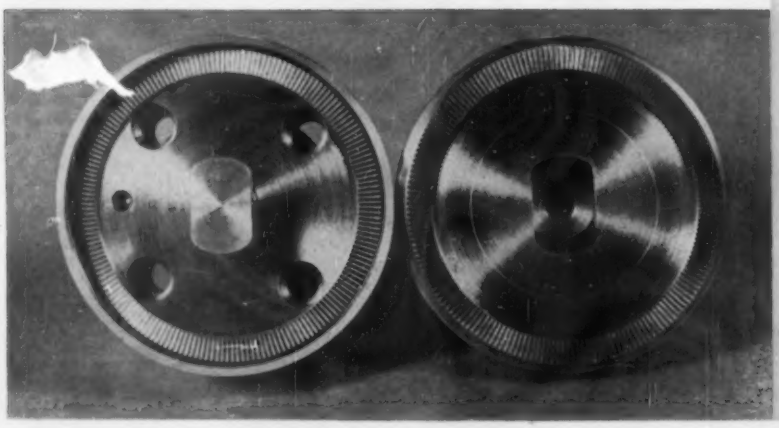
DESIGNED FOR PRODUCTION

Serrated Boring Head Cuts Setup Time

Boring tools can be removed from and returned to this machine to within several millionths of their original settings. This is made possible by a serrated base to which serrated boring adapters are attached. Because all serrations are radial from a common center, the adapters are always returned to perfect concentricity with the base. This enables an operator to preserve the accuracy of an original setup through any number of tool changes. Designed and built by Wadell Equipment Co., Inc., of Clark, N. J., this machine is especially usefull in short-run production involving tool changes.



BORING MACHINE set up for operation. Boring tools for other operations are seen in magazine at right. Index table at center uses mating serrated surfaces for indexing.



SERRATED BASE (left) and adapter. Base is fixed to boring machine with socket-head screws. Adapter is attached to base by drawbar through headstock.

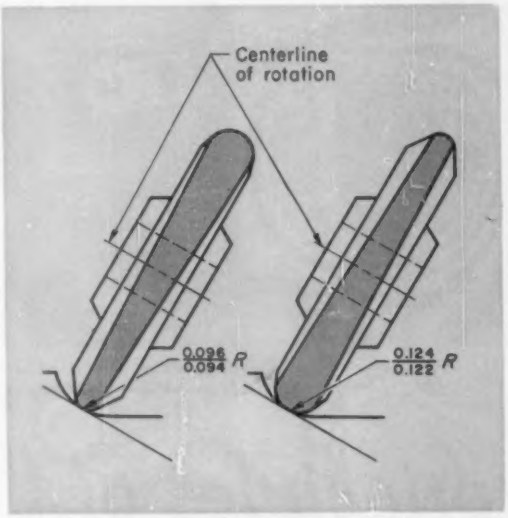
Wheel Contour Improves Burnishing

Two identical rollers, each having two different radii, are utilized to cold work automotive spindles in this machine, a specially designed product of Michigan Tool Co. Purpose of this cold working is to increase the strength and thereby the safety factor in front-wheel assemblies.

Each of the two radii covers 180 degrees of the roller circumference. At their junctures, the edges are blended, stoned and polished to obtain the smoothest possible finish. The outer periphery itself is polished to a 5 microfinish.

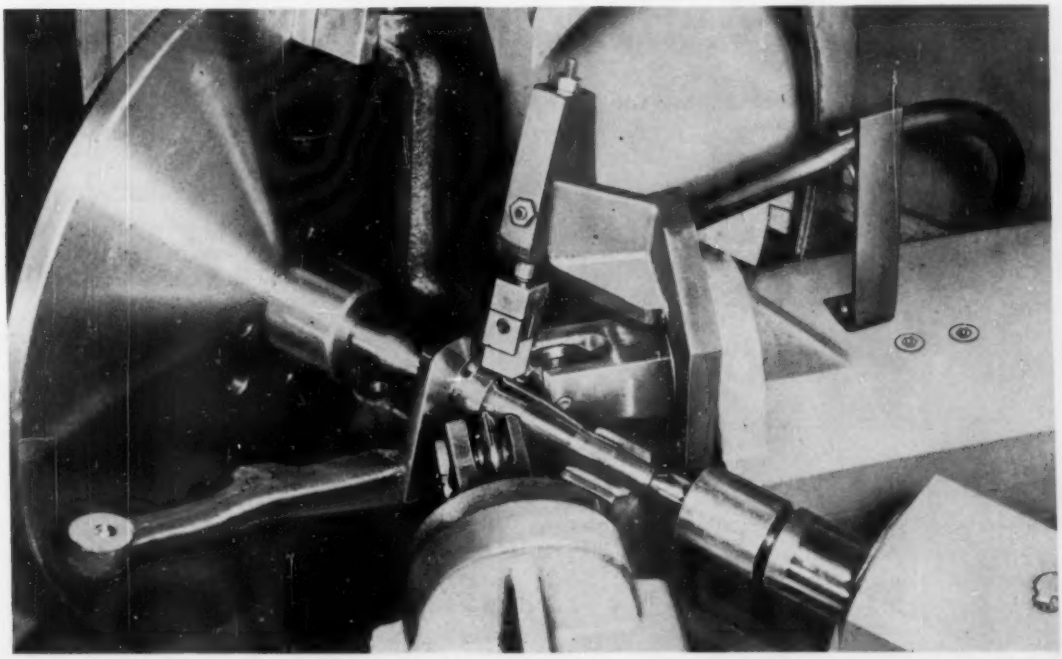
Although the radius on each half of the periphery is constant, the amount of surface contact varies constantly due to the manner in which the sides of the rollers are beveled. This angular design enables the outer contact line of the roller to move up and down the sides of the fillet and thus increase the cold working effects.

In use, the rollers are mounted in toolholders that permit free axial movement. This movement plus constant inward pressure on the toolholder forces the rollers to the center of the fillet—the point at which increased strength is required.



ROLLER POSITIONS at minimum and maximum contact. Constantly changing edges of radial periphery improves cold working effect.

BURNISHING OPERATION on automotive spindle. Workpiece is held between centers and driven by block on faceplate.



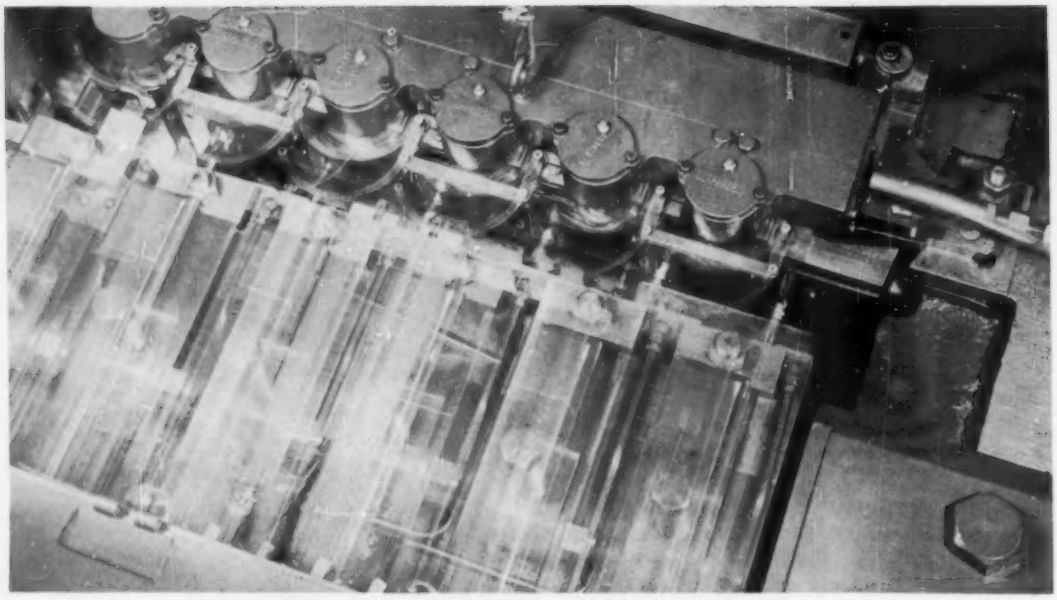


Fig. 1. Speed of operation of a progressive cold former is captured in this simulated strobe photo. Parts produced are sparkplug shells.

principles of COLD FORMING

Part 2—Designing the dies

By Daniel B. Dallas/Associate Editor

Development of the seven-station progressive former has brought the art of cold forming to its maturity. How this machine works, what it can do, and the basic principles involved in its die design are discussed in this article.

COLD FORMING as it is practiced today offers modern industry many advantages in the production of complex parts. The principal advantages of the process are its ability to extrude metal in two directions—forward and backward—to upset it and to finish it to a desired part shape without scrap loss. Because the formed parts have increased strength as a result of cold working, product designers are able to design small components with reliability factors unobtainable in similar parts produced on more commonly accepted machines.

Much of the current success of the cold forming process can be attributed to the development of progressive cold formers that move the workpiece from one die station to another. In effect, these machines are automated production lines into which raw stock is fed and from which finished parts emerge. An excellent example of a progressive former is shown in *Fig.* 1. Shown driving six forming dies into a set of complex extruding dies, this machine is transforming coiled 1010 steel wire into finished sparkplug shells at a rate of 50 parts per minute. Waste produced in this series of operations

is minimal, the only loss being a small slug that is pierced from each shell. Dimensions are held to exacting tolerances—as close as 0.002 inch on outside diameters—and an extremely thin wall is produced.

Since these facts may not seem startling to engineers accustomed to modern high-production methods, it should be pointed out that formerly such parts were made on automatic screw machines at rates considerably less than 50 per minute, that the workpiece material was hexagonal bar stock, and that material waste exceeded 70 percent. These facts do not imply a superiority of the cold former over the automatic screw machine; indeed the automatic is far superior to the cold former in many applications, particularly those in which threading and tolerances closer than 0.002 inch are required. Nor should the two machines be regarded as competitors, although there is a certain amount of overlap in their respective ranges of application. Actually, this cold former, a development of National Machinery Co., Tiffin, Ohio, comes into its own in the production of extruded parts such as those shown in *Fig.* 2. These parts can be produced from unwinding coil stock in a series of die operations and, as such, they are *prima-facie* evidence that modern cold forming processes have come of age.

Fig. 2. Display of cold formed parts, showing the range of application of the progressive cold former.

Machine Operation: Manufacturers of cold formers dislike the use of the word "press" with reference to their machines. "Horizontal press" describes the cold former perfectly, however. It contains a series of dies mounted in the vertical plane and a series of punches mounted on a horizontally moving slide. Unlike conventional presses, the cold former is designed and built with a predetermined number of die stations. The die designer is not required to use all die stations for a given job but he cannot use more. For example, the seven-station cold former shown in *Fig.* 1 has one cutoff station and six die stations. This means that all extruding, forming, coining, swaging, embossing, trimming and piercing must be accomplished in six dies. This in itself is a test of the designer's ingenuity and explains in part why cold forming die engineers are in constant demand.

In operation, the coiled wire is pulled into the machine by two large rollers. These rollers pull the wire through straightening rolls that eliminate all kinks and curvature. The wire then advances into the first station where it is cut off, an operation discussed in the first article in this series. The cutoff part, which is referred to as the blank, is then advanced from die to die by a transfer mechanism, *Fig.* 3. This unit is basically a series of pinion gears actuated by a rack. Movements of the rack are linked to movements of the slide to insure coordination between die activity and part transfer.

During part transfer, fingers shaped to part forma-

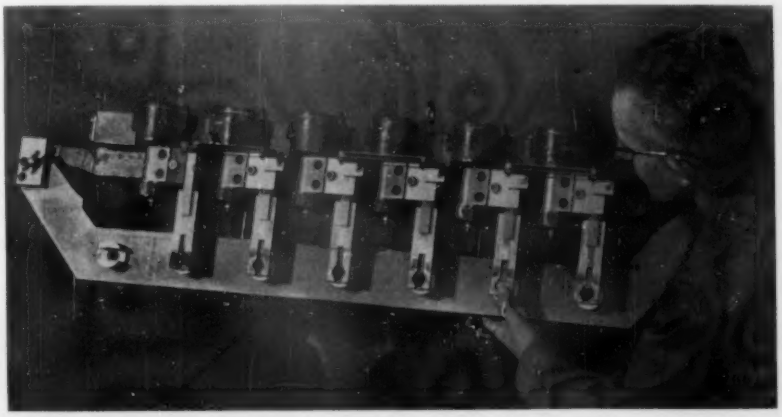


Fig. 3. Transfer mechanism for a seven-station cold former. Cylindrical component above each station is a gearbox. Fingers must be altered to conform to individual part design.

tion swing radially between the stations to pick up and move the parts from die to die. This radial movement greatly increases the versatility of the cold former since it allows the workpiece to be reversed through 180 degrees between any two stations if such a movement is desired. In some cases this reversal is desirable to provide for working at both ends of the part. In the unit shown in *Fig.* 3, part reversal is not required and to prevent it, small bars are mounted between the individual transfer fingers. These forestall any radial movement of the fingers within the individual transfer arm. Should the machine be retooled for a job in which part reversal is required, it will be necessary only to remove the bar at the proper die station.

Like stamping dies, cold forming dies must be stripped of their parts at the conclusion of each operation. Stripping is effected by knockout pins located in each of the dies. At the conclusion of each operation cam-actuated rocker arms at the front of the machine advance the knockout pin through the die, effectively ejecting the part, *Fig.* 4.

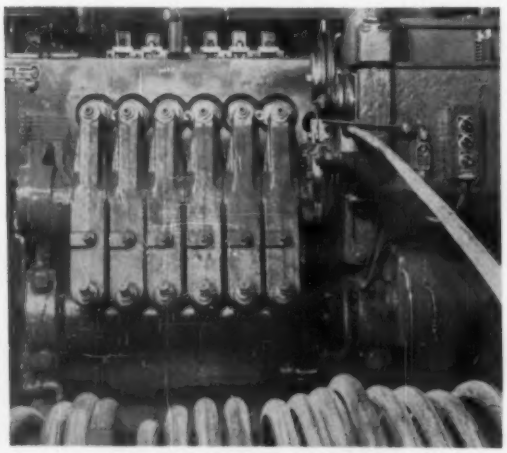


Fig. 4. View of the seven-station knockout levers immediately in front of the die area. Actuated by a cam shaft, the levers eject parts from the heading and extrusion dies at the completion of each operation.

While these topics—stock feeding, part transfer and ejection—cover the salient points of the seven-station cold former, they do not tell the big story. In capsule form, this story is simply that seven die stations provide the die engineer with hitherto unobtainable opportunities to cold form metal. Before this machine was developed, five forming stations were the most at the designer's disposal. The addition of the sixth forming station has opened new vistas to the manufacturing engineer in that it has made the working of bar type stock as flexible an operation as the forming of sheet metal.

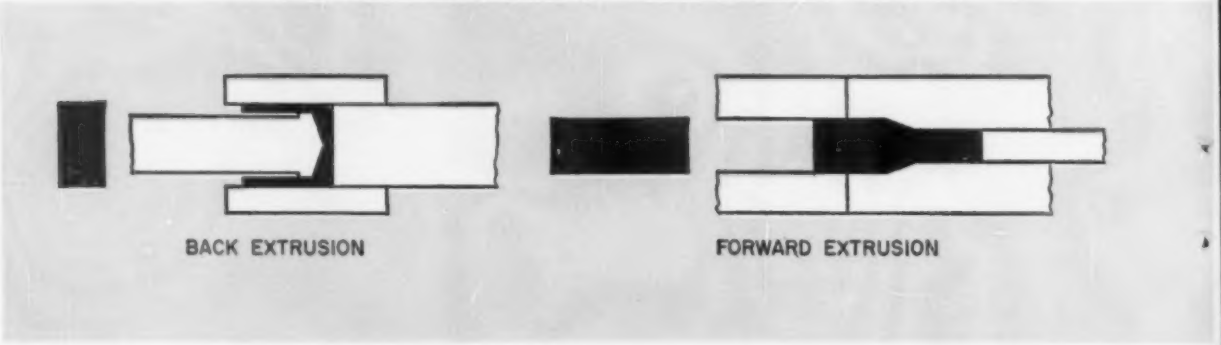
Types of Operations: Two forms of extrusion are utilized in cold form die design—forward and back. In forward extrusion the blank is forced into a die, the cross sectional area of which is smaller than that of the stock itself, *Fig.* 5. In back extrusion, the blank is contained and is forced backward by the pressure of the advancing punch. Added to these is a third, the upsetting of one end of the blank to form a head or to increase cross sectional area at any point in the part.

There are a number of variations of each of these operations but these three are the basics of cold forming. Utilizing them singly or in combination, the designer can arrive at the complex shapes shown in *Fig.* 2.

Forward Extrusion: Two types are possible—radial and angular, *Fig.* 6. In most cases radial extrusion is preferred because the change in the cross section is not as abrupt, and sharp internal corners are eliminated. Radial dies show less tendency to gall, less tonnage is required and the parts have better grain structure. Ideally, R equals $D-d$ when reduction in area is in the 40 to 70 percent range. Angle α is variable, generally approximating 45 deg. Preferred die material is carbide or M-4 hardened to Rc 63.

Back Extrusion: Punch design is critical in this operation, *Fig.* 7. Punch is first ground to A' after which angular face and radius E are ground and polished. It is then possible to grind A. Sharp corner

Fig. 5. Three basic operations performed in cold forming machines. Combinations and variations of these operations give the cold former a wide range of applications.



is necessary since full radius increases drag on punch by causing the metal to turn in. Because this operation is difficult to lubricate, careful attention must be given to corner design. Recommended punch materials are carbide, and M-4 hardened to R_C 64-66. Recommended die material is carbide or M-4 hardened to R_C 63.

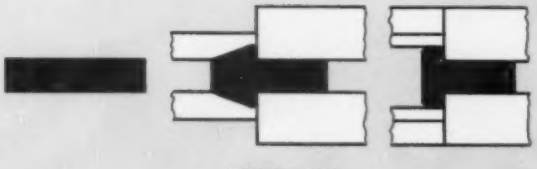
UPSETTING: Also referred to as gathering or forming. In this type of operation the cross sectional area is increased, not decreased. In addition, the action takes place within the punch, not the die. *Fig.* 8. Length *A* is found by dividing calculated volume of finish upset by cross sectional area of stock. Dimension *C* equals *B* multiplied by 1.25.

Other important operations include shearing and piercing. These can be performed in cold formers as easily as they can in sheet metal presses.

Die Design: Punches for cold forming applications generally follow the design shown in *Fig.* 9. Essential components are a punch holder, two filler blocks and the punch itself. The filler blocks are backed-up by a wedge that provides adjustments of $\frac{3}{8}$ inch in punch length. Additional adjustments can be obtained by using different length fillers.

In addition to their functions as spacers, fillers are designed to distribute the load of the punch. As such, the filler next to the wedge distributes the load over a comparatively large area. Fillers should be hardened but as they increase in size, specified Rockwell hardness decreases. In the assembly shown in *Fig.* 9, for example, the filler immediately back of the punch is hardened to R_C 62; the next one is hardened to R_C 60. The wedge itself is hardened to R_C 46-50.

The die assembly at each station follows the design shown in *Fig.* 10. The two die inserts—referred to as nibs by cold forming designers—are held in proper position with a threaded insert. This insert, which rests against a faceplate, bears the load imposed by the forming of extruding action of the punch in the die. The outer component, which holds the nibs and the insert, is referred to as the



UPSETTING

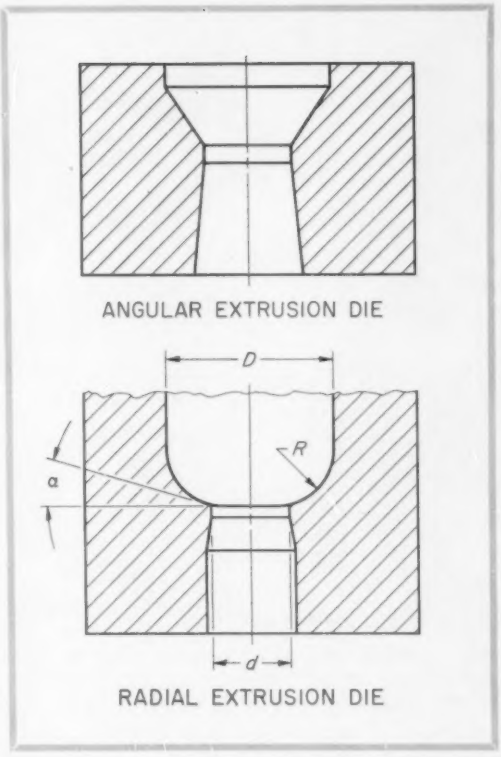


Fig. 6. Two basic types of forward extrusion die. Each has its place and although their functions overlap in certain areas, both are necessary.

die case. Cases are generally made out of H-13 steel, hardened to R_C 50-54, and precision ground. The upper nib is held in the die case by a conical interference fit.

Two noteworthy die design features are found in this assembly. First, the part configuration is established with two nibs, a design that greatly facilitates die construction. Second, full annular bearing of one nib on another is obtained by grinding a slight angle on the lower nib. This angle should not be ground to an indiscriminate size, however. The outer extremity of the angle drops only 0.002 to 0.003 inch from the flat, and the flat itself is obtained by formula. In cases where *D* is approximately equal to 2*D* the diameter ϕ is obtained with the following formula:

$$\phi = .7\sqrt{D^2 - d^2}$$

In this assembly, as in many others, the knockout pin has an important role in part formation. Inserted through the lower nib with a gage fit, the end of the pin acts as the lower extremity of the die cavity. As such, it must be able to withstand the force exerted by the extrusion punch without any loss of its mobility. Knockout pins are O-1, T-1 or M-4 and are hardened from 59 to 66 R_C,

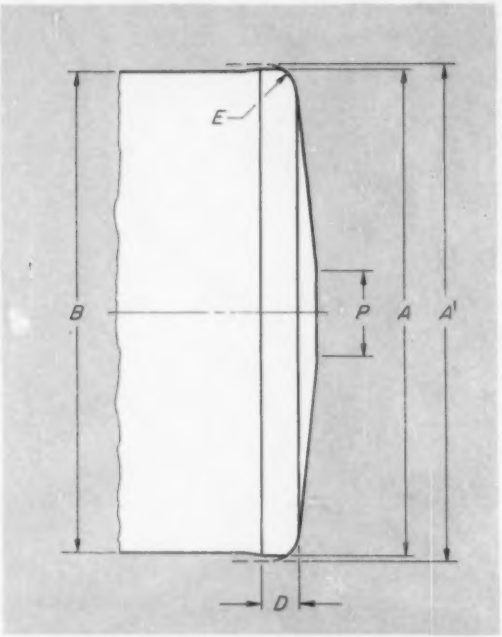


Fig. 7. Critical area of a reverse-extrusion die is its point. Proper attention to design of the point reduces tonnage requirements and aids plastic flow.

depending on the applications in which they are used.

To maintain reliability and insure maximum tool life, it is necessary to hold a tight relationship between the diameter of the nib and the diameter of the die case. The rule of thumb generally practiced is that dimension *E* should be equal to or greater than 2*D*. Dimension *F* should be long enough to permit entry of the pilot portion of the back-up unit before thread engagement takes place.

Horn Core Layout: A good example of a cold forming layout is shown in *Fig.* 11. In this design a total of six stations, including cutoff, are utilized to convert a slug of 1108 mild steel heading wire into the vibrating unit of an automobile horn. The operations performed in this sequence are cutoff, extrusion, upsetting, drawing, and pierce and trim. Although this is a relatively simple sequence, it is noteworthy that eight separate operations are performed in six stations. Two of the stations do double duty by performing two operations apiece.

After the blank is cut off it is transferred into a sizing die for final preparation of the ends. It then moves into an extruding station in which the basic operation shown in *Fig.* 2 takes place. The blank is forced against an extruding punch, causing metal to flow along the outside wall of the die. The part is then stripped and transferred to the fourth die station where it is headed and sized. In this operation the part is forced into a constricted area by an advancing heading punch but prevented from collapsing by a sizing mandrel centered in the die. Part entry into the sizing die is limited by the knockout assembly which serves as the lower extremity of the die cavity. Continuing advance of the heading punch forces the end of the part to upset and form the desired head. Because square corners are required, restriking is necessary. Mechanically, this station is a duplicate of the fifth station, the only difference being sharpness of corners.

At this point the part is complete except for a pierced hole and a trimmed edge, two operations that are performed in the sixth and final station. These are easily effected by pushing the part down past a trim insert and over a stationary piercing punch. Stripping action by the knockout ejects the finished part from the die.

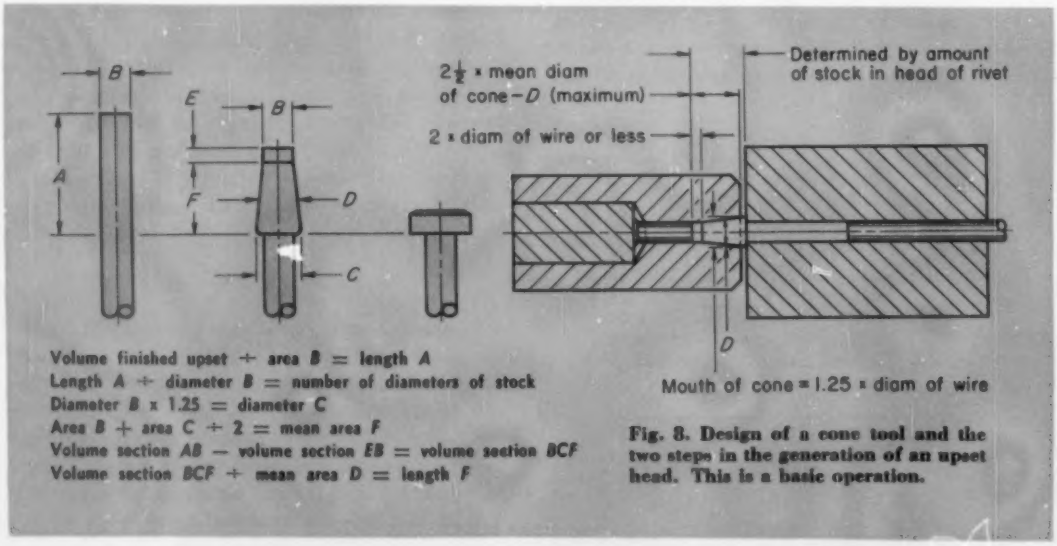

B
E
B
A
F
D
C
2½ × mean diam of cone–D (maximum)
2 × diam of wire or less
Determined by amount of stock in head of rivet
D
Mouth of cone = 1.25 × diam of wire
Volume finished upset ÷ area B = length A
Length A ÷ diameter B = number of diameters of stock
Diameter B x 1.25 = diameter C
Area B + area C ÷ 2 = mean area F
Volume section AB – volume section EB = volume section BCF
Volume section BCF ÷ mean area D = length F

Fig. 8. Design of a cone tool and the two steps in the generation of an upset head. This is a basic operation.

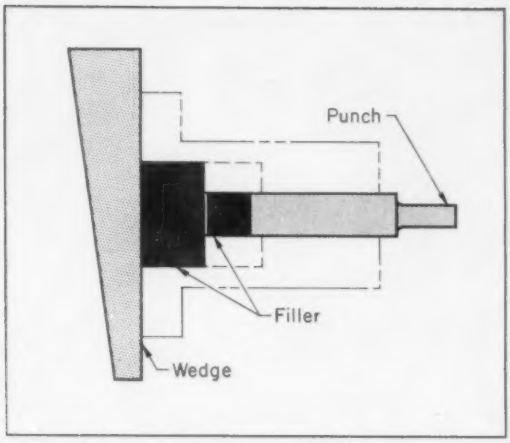


Fig. 9. (above) Typical punch design for a progressive former. Filler blocks immediately behind head distribute the load and provide adjustments beyond the scope of the wedge.

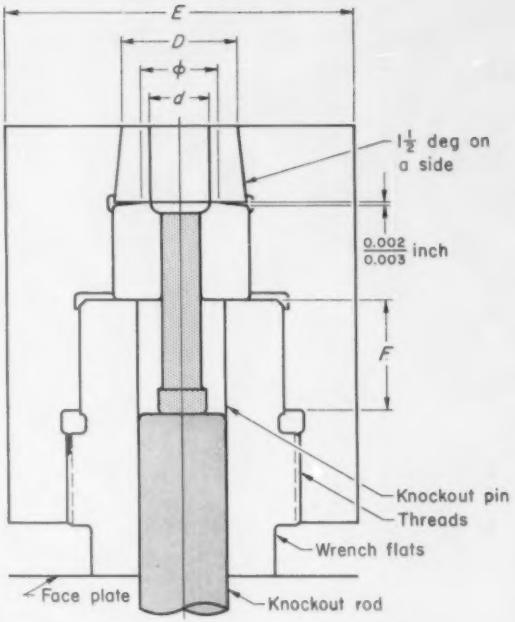


Fig. 10. (right) Forward radial extrusion die as it is designed for assembly in a progressive cold former. This assembly typifies cold forming die design.

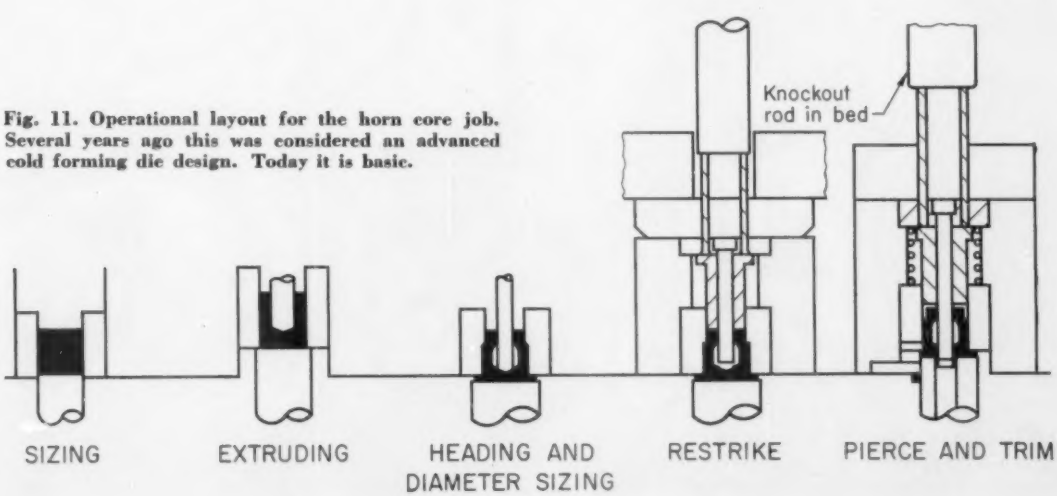
Conclusion: In attempting to summarize the rules of cold forming, it must be concluded that any such attempts can be only partially successful. The information listed in this series plus the reference information listed on page 91 are the basics of the art. Once they are assimilated, cold forming design becomes a matter of experience.

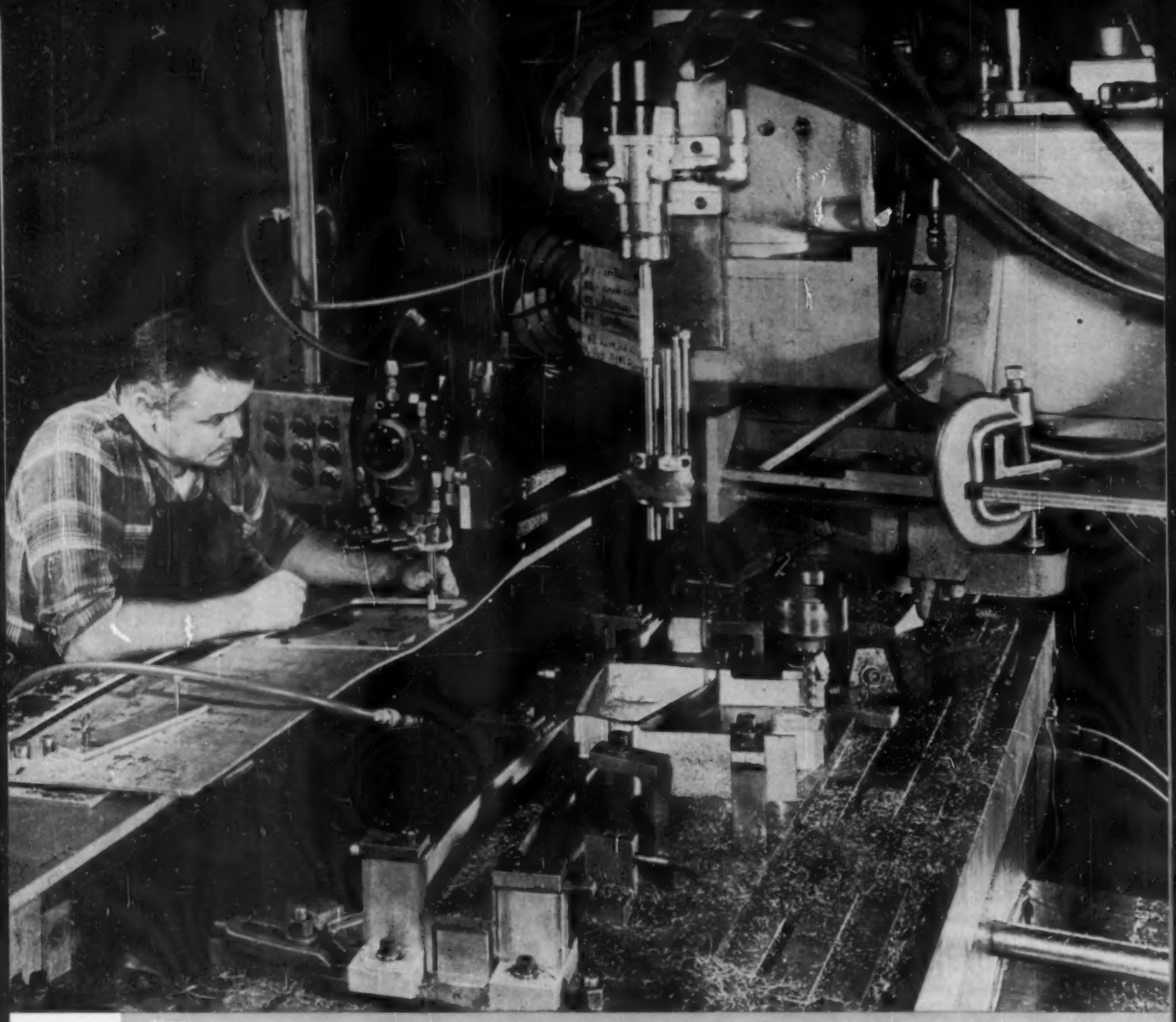
One engineer, outstanding for his knowledge of the field, was asked, "How do you know a certain cold form design will work where another will fail?" His answer: "I suppose it's a matter of instinct . . . call it experience if you like. And the trouble is we don't always know. Sometimes we're forced to use an empirical approach—we build a test die, set it up and see what happens. Whether or not it works, we've usually learned something about cold forming that we didn't know before. Whatever we learn becomes part of our collective knowledge."

Concurring in this opinion, another engineer states that cold form tool design calls for experience and experimentation in a 90-10 ratio.

In making an appraisal of the present state of the art, it can be said that the seven-station former has given the engineer an important and highly productive tool the full potential of which has yet to be realized. When it is, he may expect that an eight-station cold former will be unveiled.

Fig. 11. Operational layout for the horn core job. Several years ago this was considered an advanced cold forming die design. Today it is basic.

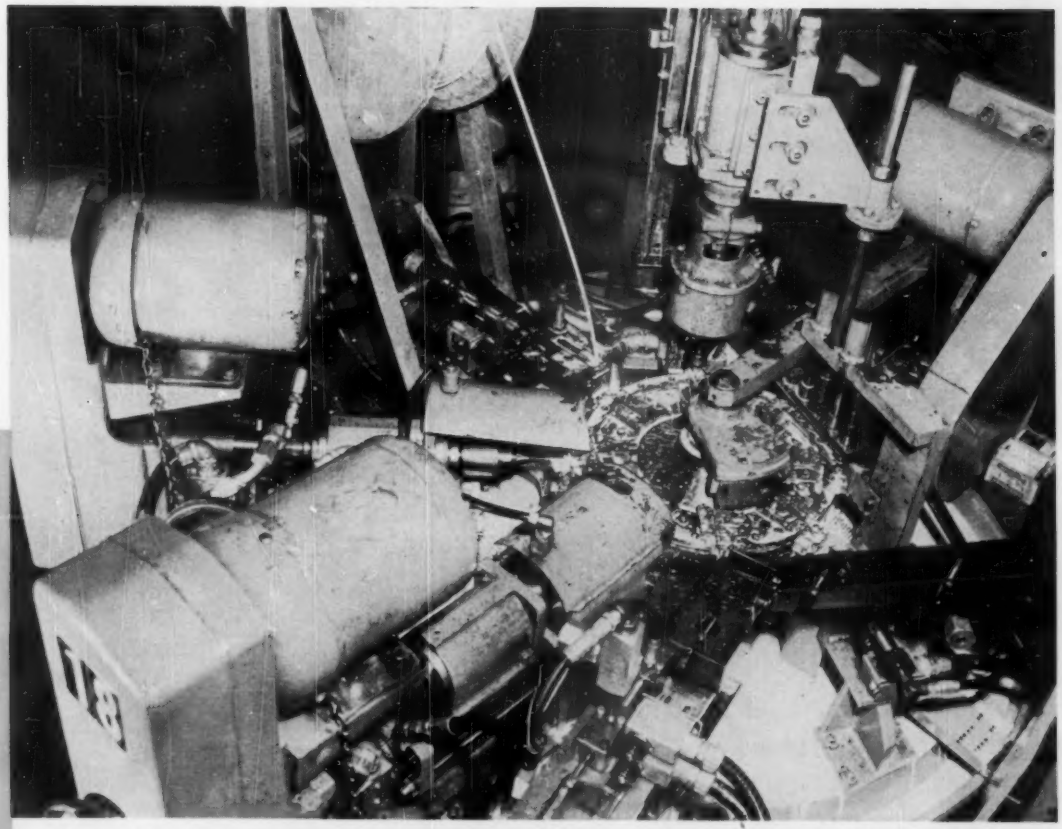




EQUIPPED with a special head capable of delivering from 23 to 1800 rpm, this special machine at Shinn Engineering, Inc., Santa Ana, Calif., can contour a wide range of metals from aluminum to molybdenum. Here the operator is profiling from an overlay type template for a 360-deg tracing on the main landing gear fuselage support fitting for the Douglas DC-8. The part is of high-strength 4340 steel.

TOOLS at work

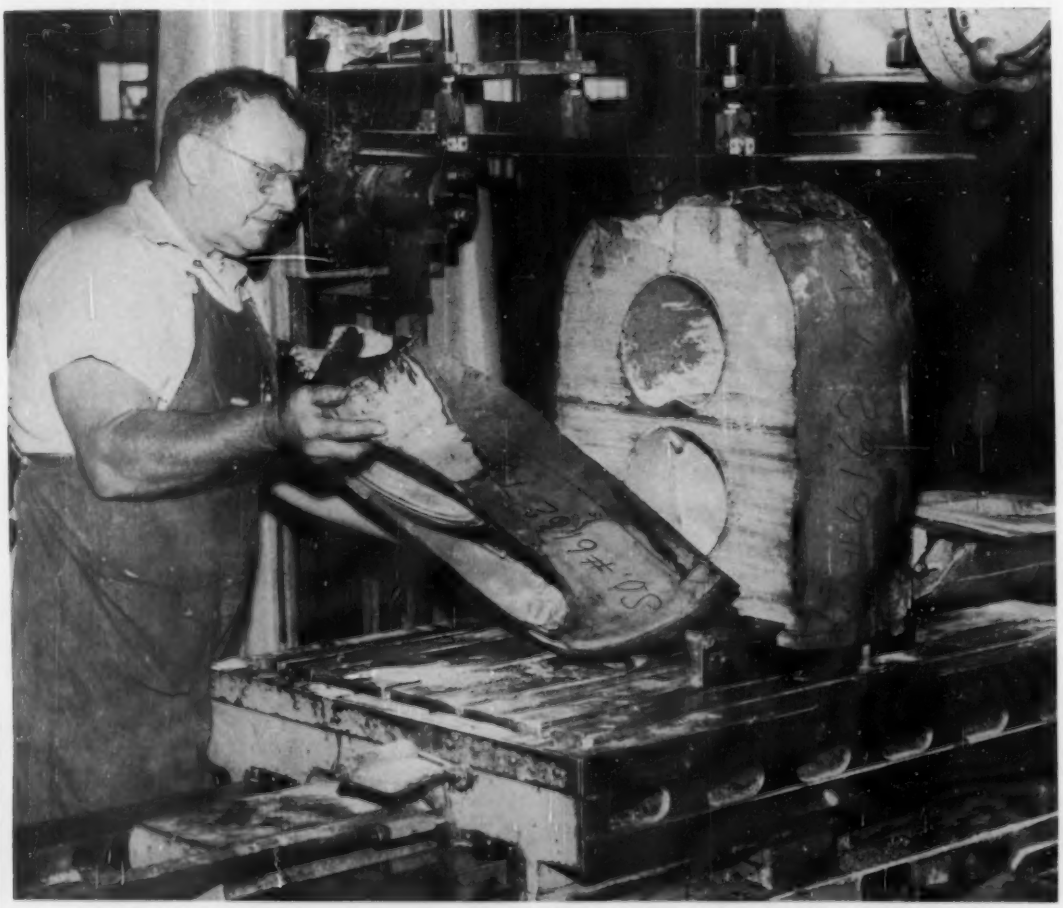
PLASTIC BUBBLE, supported by air pressure, is used by R. K. LeBlond Machine Tool Co. during trial runs of new tape-controlled lathes. The bubble is air conditioned and can maintain temperature within 5 deg F of setting when shop temperature varies as much as 25 deg. It is attached to the floor by pipe cleats and can be easily moved from one lathe to another. The controlled environment is important when bringing into balance the operating characteristics of the lathe and its associated tape control system.

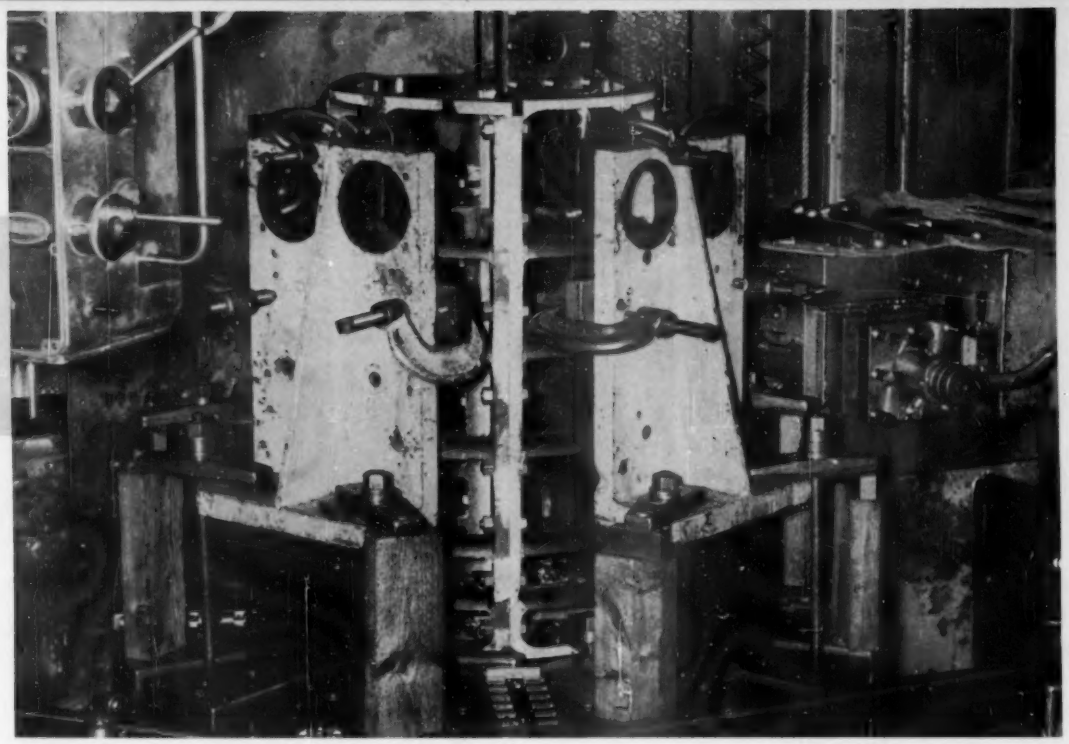


INSERTING nylon pellets in the threaded area of nuts is the job of this machine at the Paramus, N. J., plant of Nylok Corp. In a series of steps the machine drills a large-diameter hole halfway through the outside wall of the nut and a smaller hole through the inside wall. The nylon pellet is then inserted, and the nut and pellet are tapped. Then metal is staked over the back of the pellet and the machine automatically inspects the finished product, ejecting any imperfect nuts. Production is at a 60-per-minute rate.

TOOLS at work

HORIZONTAL boring mill has been converted to a saw for handling special cutting projects at the U. S. Naval Ordnance Laboratory, Silver Spring, Md. The workpiece is a case for an aluminum practice mine 2½ feet long, filled with cement, tar and vermiculite. An eight-foot-long bandsaw blade is fitted around two 10-inch-diameter plastic pulleys—one mounted on the mill's auxiliary vertical head, the other on the tailstock end of the mill. Downward pressure is provided by guides and rollers that also keep the blade straight as it revolves around the pulleys. During sawing, the blade is fed down at a rate of 0.25 ipm to simultaneously cut two five-inch thick slabs off the sides of each mine. Total cutting time is about two hours. Cut-off slabs are examined by ordnance engineers to determine causes of structural failures. Findings are important in developing better mines.





TYPE 304 STAINLESS STEEL casting is bored on a 50-hp Bullard VTL, using carbide inserts. The frame-like casting has a 16.300-inch-diameter bore. The relatively delicate, open construction of the casting necessitates a number of cuts in order to prevent distortion. Severe interrupted cutting adds to the difficulty of boring. Kennametal Grade K1 throwaway inserts are used in a positive-rake toolholder. Four rough passes are made with 1/8th-inch depth of cut at 37 rpm; one semifinish pass with 0.010-inch depth of cut at 45 rpm; and one finish pass with a 0.003-inch depth of cut at 54 rpm. Feed is 0.0104 ipr. Finish tolerance on the bore is +0.005, –0.000 inch.

OPERATING on aluminum at speeds from 1800 to 3600 rpm with depth controlled by a 3-D tracer, this machine can take internal and external swarfing cuts while contouring in three dimensions. Hydraulic modifications to the tracing equipment coordinate with hydraulic attachments on the trunnion fixture, set for this job at 28 deg. The table tips to ±15 deg. A 180-deg tracer valve on rise-and-fall cams creates desired angles for different stations. The machine is at Shinn Engineering, Inc.

what you should know about
CHEMICAL COOLANTS

By Felix Giordano
Associate Editor

CHEMICAL COOLANTS, hardly known a few years ago, are coming into their own. With the advent of new compounds, previous objections to the use of chemical coolants have been swept away and these modern coolants are being put to work in hundreds of up-to-date metalworking plants. Shop experience has proved that chemical coolants can do a job and, equally important, that they can often cut over-all machining costs. They're worth a try in your plant.

Why Chemical Coolants: There are four reasons why you'll be interested in chemical coolants:

- They have high heat-removal rates. Translated into speeds and feeds, this means higher machining rates, as in fast turning of alloy steels used in gears and shafts. These higher speeds are accompanied by increased tool life and add up to lower unit cost of machined parts, increased plant capacity.
- They have long useful life. Barring substantial contamination with lubricating and hydraulic oils, chemical coolants last considerably longer than other machining fluids.
- They keep coolant systems open. This is especially true of coolants containing wetting agents, whose detergent action prevents clogging of pipes and also helps in the settling and recovery of chips.
- They facilitate part processing cycles. Chemical coolants with wetting agents have a high compatibility with other processes, such as washing. Often they permit elimination of an intermediate processing step.

No Cure-Alls: These fluids are blends of a number of chemical components dissolved in water. All are used as coolants. Some lubricate as well.

They are not nostrums to be used indiscriminately on any machine in any metalcutting operation. In some instances the design of the machine precludes the use of any water-base compound. This is true not only of older machines, but of some newer models as well. Before switching to any water-base cutting fluid it is best to get the advice of the machine manufacturer.

Most common reason why a machine tool will not work well with a water-base coolant is that the design of the machine permits the coolant to penetrate the machine's lubrication system. In some instances, special water-resistant oils and greases in the machine can solve the problem. More often it is simpler to forego water-base fluids.

Too, oil-base lubricants or hydraulic oils might leak out of the machine's mechanism into the chemical fluid in amounts sufficient to reduce the quality of its performance.

Again, in some machining operations, such as tight tapping and finish reaming, metal removal rates are low, and lubrication, rather than cooling, is the primary requirement. In such cases, oil-base fluids are preferred, though current research might alter that situation in the near future.

Materials to be machined, too, must be considered. As a general rule, chemical coolants work best on ferrous metals, yet many aluminum alloys can be machined with them, and at very high speeds. Most standard chemical fluids are not recommended for machining alloys high in magnesium, zinc, cadmium, or lead.

Problems: There are negative aspects to chemical coolants, too, though they can be remedied. These may cause problems:

- Some paints used on machine tools may be removed by the particular chemical coolant that would otherwise be best. This not only spoils the appearance of the machine tools,

Based on information supplied by both users and producers of chemical coolants, this article tells you what chemical coolants are, when to choose them and how to pick the one best suited to the special needs of your shop.

but, by allowing the paint to be kept in suspension in the coolant, permits its later being deposited on machine working parts, with resultant gumming and sticking. Some paints, especially those with epoxy or acrylic bases, are immune to this attack.

- Crystallization of contituents caused by solvent evaporation during shutdowns occurs with some—but not all—chemical coolants. Most affected are machine tool parts where the chemical solution normally exists in a thin film, as on ways, tool slides and similar components. Even overnight evaporation is normally sufficient for this trouble to develop. In such cases a machine may have to be run for an hour or more on restart before it achieves its standard accuracy and repeatability. You can eliminate this trouble by choosing a chemical coolant that doesn't leave a sticky or tacky residue.
- Like all other cutting fluids, chemical coolants are proprietary, are not sold on the basis of chemical analysis. A reliable vendor of proven experience can be of decided assistance in helping you select the product best suited to your machining needs and to your production equipment and setup.

Water Modifiers: Main functions of cutting fluids in any machining operation are to provide lubrication between chip and tool, and to control the temperature of the cutting tool. Accordingly, all cutting fluids start either from a petroleum-base or from a water-base. Petroleum-base fluids have good lubricating characteristics, but have a heat removal rate that is often insufficient, especially with large feeds and high speeds. Water-base fluids have excellent heat removal rates, but more limited lubricating ability.

Chemical coolants are water-base fluids. Their main task is to cool the cutting edge of the tool to keep the tool face and flank below the critical hardness temperature. The flow of coolant also helps the chip to break by reducing its ductility through partial cooling. It must be stressed that a temperature differential between tool and chip is absolutely necessary to control welding and tool erosion.

Water has long been recognized as the most efficient cooling agent, but it has a number of objectionable characteristics. Chief among these are the tendency to rust both the machine tool and ferrous workpiece, and the lack of lubricating ability. Also, in the presence of proper nutrient, water permits the growth of bacteria. And mineral content of water tends to increase corrosive reaction, while dried deposits from such water can increase wear.

Products that are generally classified as chemical coolants are really chemical modifiers of water. Their primary function is to reduce the undesirable side effects of water used as a cooling agent. Where lubricity is required, soaps, wetting agents and "chemical lubricants" are incorporated in the modifier to perform this function.

Most chemical coolants now incorporate lubricating agents, and some companies refer to their compounds as chemical cutting fluids rather than as chemical coolants or synthetic coolants.

Chemical Constituents: There is a surprisingly limited number of chemical agents that can go into chemical coolants:

Amines and nitrites—for rust prevention
Nitrates—for nitrite stabilization
Phosphates and borates—for water softening
Soaps and wetting agents—for lubrication and to reduce surface tension
Compounds of phosphorus, chlorine, and sulphur—for chemical lubrication
Glycols—as blending agents and humectants
Germicides—to control bacterial growth

The action of some of these ingredients is known. Others are used empirically. For instance, there are various theories as to the exact action of the chemical lubricants—the compounds of phosphorus, chlorine, and sulphur—but their beneficial action is backed by long use in oil-base fluids.

If the number of ingredients is limited, the number of their possible combinations is very large indeed, giving rise to the great variety of chemical coolants now on the market. As each of these coolants is a blend, or mixture, rather than a chemical compound, the ingredients that go into it and the proportion in which they are blended reflects the philosophy of the blender. In some instances this philosophy is based on extensive research, development and testing programs.

Three Classes: Individual variations aside, chemical coolants can be divided into three major classes based on lubricant content:

Check these before picking a chemical coolant:

WORKPIECE MATERIALS. Some of them are attacked by chemical coolants. Check especially magnesium, lead, zinc, cadmium.

MACHINE DESIGN. If the chemical coolant can get in the machine's lubrication system, chances are the chemical coolant—or any water-based fluid —is out. Excessive leakage of lubricating oils into the chemical coolant changes the nature of the coolant and reduces its efficiency.

MACHINE PAINT. Some paints are attacked by many chemical coolants. Paints with an epoxy or an acrylic base are satisfactory.

COOLANT CRYSTALLIZATION. Bothersome at best, at worst this can ultimately impair machine operation. If you choose a coolant that does not crystallize on evaporation you will probably save money in the long run.

LIFE. Main limiting factor of most water-miscible coolants is high concentration of bacteria. These cause unpleasant odors, accelerate corrosion and attack some important constituents in the coolant. Select a coolant with good resistance to bacteria growth. Both type and concentration of germicide are important.

1. Pure coolants. These contain no lubricants, are made up mostly of water softeners and rust inhibitors.

2. Coolants with mild lubricity. Contain water softeners, rust inhibitors and wetting agents.

3. Lubricating coolants. Compounded of water softeners, rust inhibitors, wetting agents and chemical lubricants—chlorine, sulphur and phosphorus additives, alone or in combinations.

Fluid type selection is based on machining operation, workpiece material and type of tool involved.

Grinding requires efficient cooling, but low, medium or high lubricity may also be indicated. Choice is a function of grit type, of work material, and of whether the operation be cylindrical, internal or disk grinding.

Carbide cutting tools' first requirement is efficient cooling. Fluids used with them usually don't include chemical lubricants, although wetting agents might be indicated. Here it is important that the coolant's residual film not interfere with machine tool action.

High speed and other tool steels require both cooling and lubrication. Fluids used with these steels should always include wetting agents and, preferably, chemical coolants, too.

Which Coolant: Choice of individual fluid within a class is more difficult and must ultimately be based on in-the-shop experience. Many fluids can perform near miracles in tool life and metal removal rates under controlled laboratory conditions but such conditions are seldom found in the shop. Too, each shop has a certain individuality, and a product that works best in one shop may not work quite so well in another.

So—accept the experience of others, but only as a guide. Test any prospective fluid in your own plant, under normal production conditions, and for a long enough period of time. If your plant has a central coolant system, the coolant you choose is likely to be a compromise between the requirements of different groups of machines. In this case, too, you should find the compromise that is best for your shop, for the particular kind of work you do.

Rule of Thumb: Because chemical coolants are primarily water modifiers, they are particularly indicated for those metalcutting operations in which the main function of the cutting fluid is to act as a coolant.

For those operations in which lubrication is very important, choose either an oil-base fluid or one of the newer chemical coolants with high chemical lubricity, in concentrations of one part of compound to five-to-ten parts of water. These compounds do not "smoke," they produce good finishes, and insure long tool life at higher production rates than would be possible with oil.

Future: Extensive research sponsored by a number of companies is continually changing the chemical coolant picture. Latest advances are in more effective control of bacterial growth, and in imparting good EP (extreme pressure) lubricating characteristics to chemical-based cutting fluids.

Additional improvements are in the wind. Each of them will further extend the field and increase the advantages of this class of fluids.

high-speed, SMALL HOLE DRILLING —numerical control ups output

By R. W. Miller

Manager
Advance Manufacturing Engineering
Missile and Armament Section
General Electric Co.
Burlington, Vt.

By providing an ingenious high-speed attachment for a tape-controlled drill, General Electric manufacturing engineers reduced drilling time 400 percent on a workpiece that has over one thousand close-tolerance holes.

MANUFACTURING ENGINEERS are facing new problems every day—problems that cannot be solved with conventional tools and tooling.

A case in point is the drilling of over one thousand 0.040-inch-diameter holes in an aluminum plate at General Electric Company's Missile and Armament Section, Burlington, Vt. This 4 x 6-inch plate is tapered, with a thickness ranging from 0.375 to 0.875 inch.

General Electric manufacturing engineers decided that the holes should be drilled on a numerically controlled machine to get optimum accuracy and output. They were, however, unable to find an existing machine that had the extremely high spindle speeds and sensitive hand feed necessary for small-hole drilling.

Their solution was to design and build the attachment shown in *Figs.* 1 and 2. This is a belt-driven unit that fits on a Model 24C Hillyer tape-controlled drill. Utilizing belt-driven pulleys and the existing

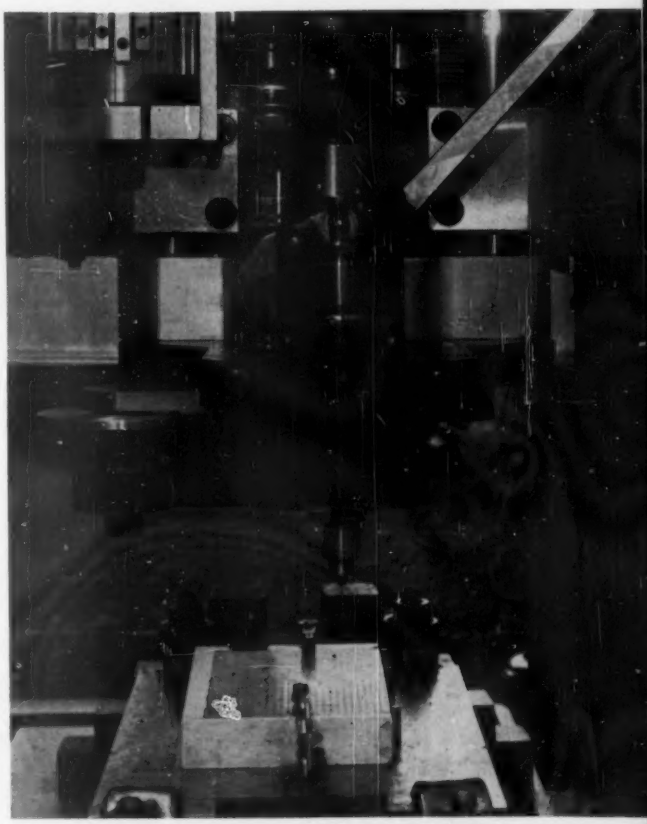


Fig. 1. Attachment for numerically controlled drill gives 18,000-rpm spindle speeds for small-hole drilling. Feed is controlled by operator, using handle at right of spindle. Drill breakage is minimal.

selection of speeds on the machine, it is possible to choose 16 speeds from 400 to 18,000 rpm—speeds that fulfill the special requirements of high-speed drilling.

A novel arrangement gives the operator the "feel" he needs to control feeds. Conventionally, spindles

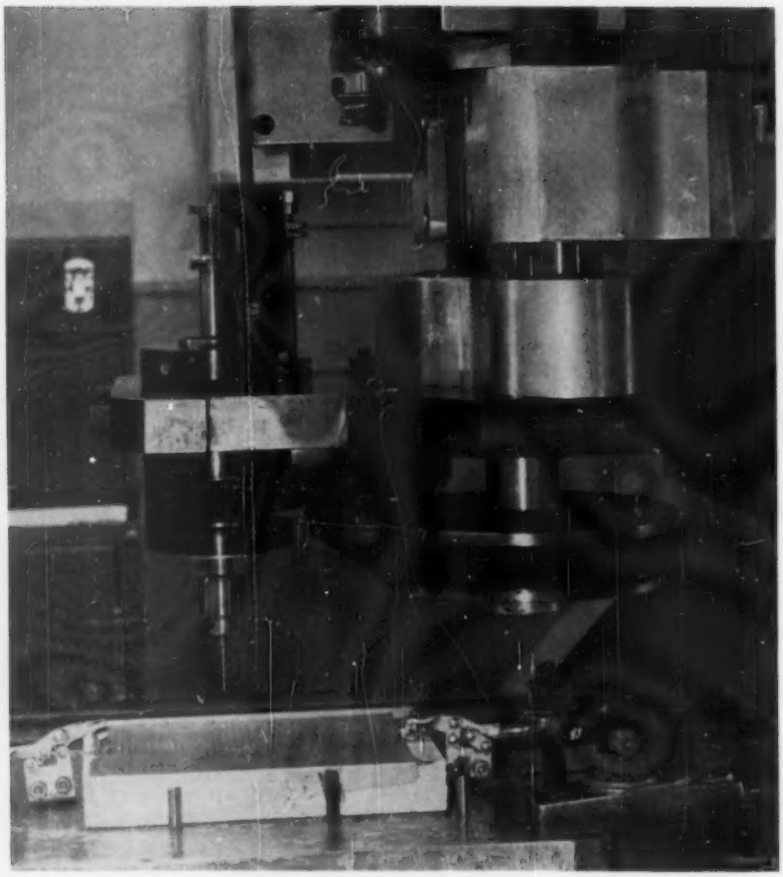


Fig. 2. Attachment for high-speed drilling. Pulley drive ups speed of spindle. Quill is stationary; spindle is fed manually by operator.

are actuated by moving a quill that contains the spindle and bearings. In the General Electric design, the spindle slides through a stable quill. Since the mass of the spindle is small, operator "feel" is extremely sensitive.

The spindle is mounted in Class 5 ball bearings to reduce friction and permit high speeds. Preloading of the ball bearings allows for minimum bearing clearance by the spindle. No bearing adjustments are required.

Equipped with mounting brackets, the attachment is bolted directly to the machine spindle housing. The machine spindle extends through the mounting plate and provides the power input to the belt drive.

Material cost for the attachment was about $25. Design time was 3 hours and build time was 32 hours. It can be readily adapted for use on other machine tools having limited feeds and speeds, even horizontal boring mills.

Before drilling, workpieces are cast-potted in plastic to compensate for the part geometry and to give sharp edges and burr-free holes. To provide the required accuracy of hole location and diameter, all holes are first spotted with a center drill. This operation is performed under numerical control. Drills with heavy webs are used for final drilling. By relying on the operator's ability to "feel" the correct rate of feed, tool breakage is kept to a minimum despite the small hole diameter and the ⅞-inch drill depth.

Normally, numerically controlled drilling is a continuous cycle. To permit hand feeding with the attachment, the automatic feed is turned off. The operator controls the "spindle up" selector switch and the table moves to position the work under direction of the tape. When the drilling operation is completed, the operator presses the selector switch again and the work is positioned for the next hole.

Since all holes are in a regular, checkerboard pattern, only one row of holes is programmed on the punched tape. When one row of holes is drilled, the head is positioned for drilling the next row of holes by using a dial input.

Machining time with the method described averages 13 hours per piece—400 percent faster than would be possible when using more conventional methods. There are other savings, hard to measure but real. Operator fatigue is reduced and there is no need to recheck manually made settings. And, of course, desired accuracy is maintained.

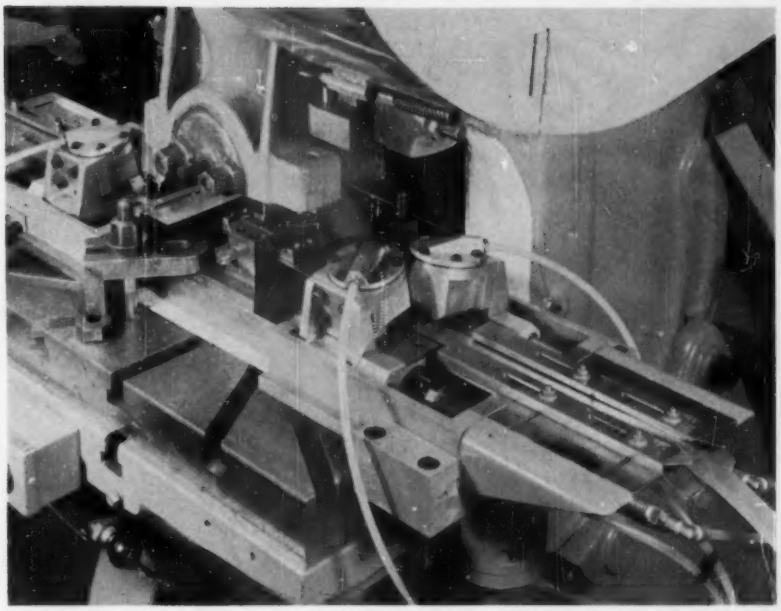


Fig. 1. Twin slide feed unit set up for operation. Upright components at each side of press ram are grippers for moving stock.

pneumatic press feeder

increases die reliability

By A. P. J. Soepnel
Eindhoven, Holland

Efficient and easily constructed, this stock feeder can be adapted to almost any type of press. In many cases its reliability makes piloting unnecessary. In all cases it is excellent insurance that the part will be properly positioned before die engagement.

INCREASING QUANTITIES of parts produced by press operations have made automatic feeding of presses a necessity in modern stamping plants. Formerly, it was possible to accomplish feeding manually but advances in press tool technology, increased speeds of operation and operator fatigue have ruled out the operator as a factor in high-speed stamping operations. As a result, many new forms of press feeding devices have appeared and have been adapted to stamping operations. While virtually all of them are successful—some more so than others—there are instances in which none is effective.

Press Feed Requirements: To be effective, any press feeding mechanism should fulfill the following requirements:

1. RELIABILITY. It must provide repetitive accuracy of feed length.
2. ADAPTABILITY. It must be adaptable to any feed rate and to any size of tool within the capabilities of the press.

Accuracy of feed length is important for two rea-

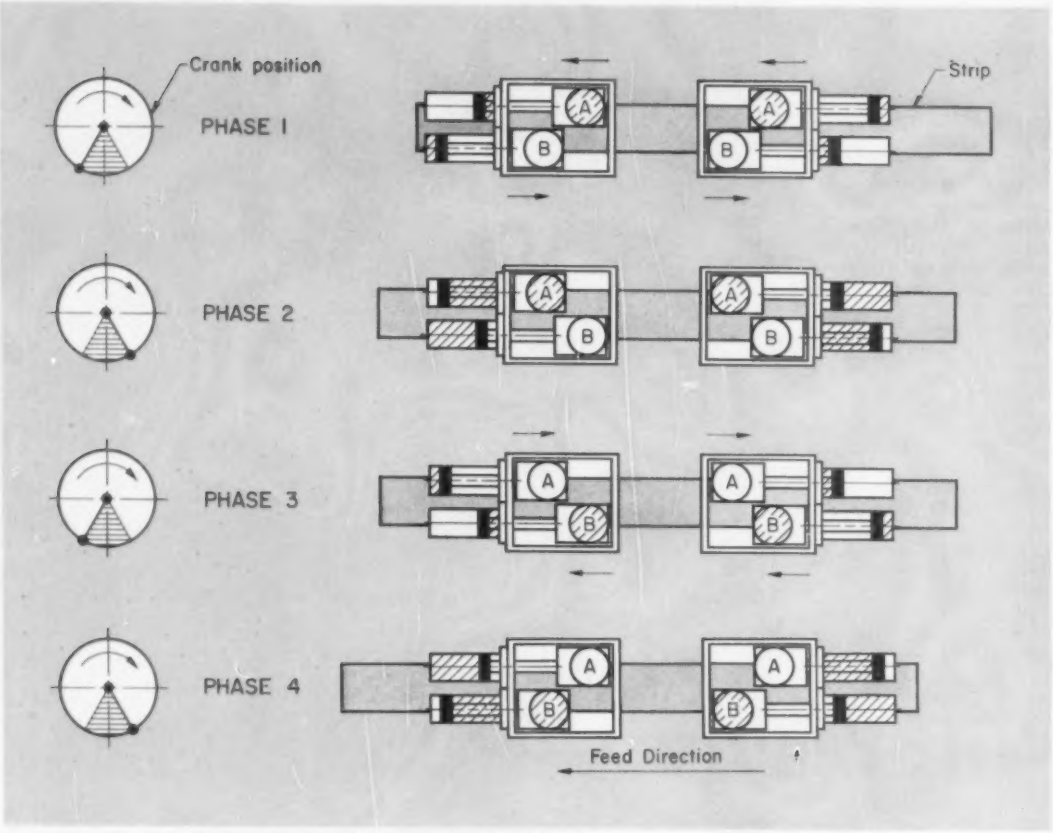


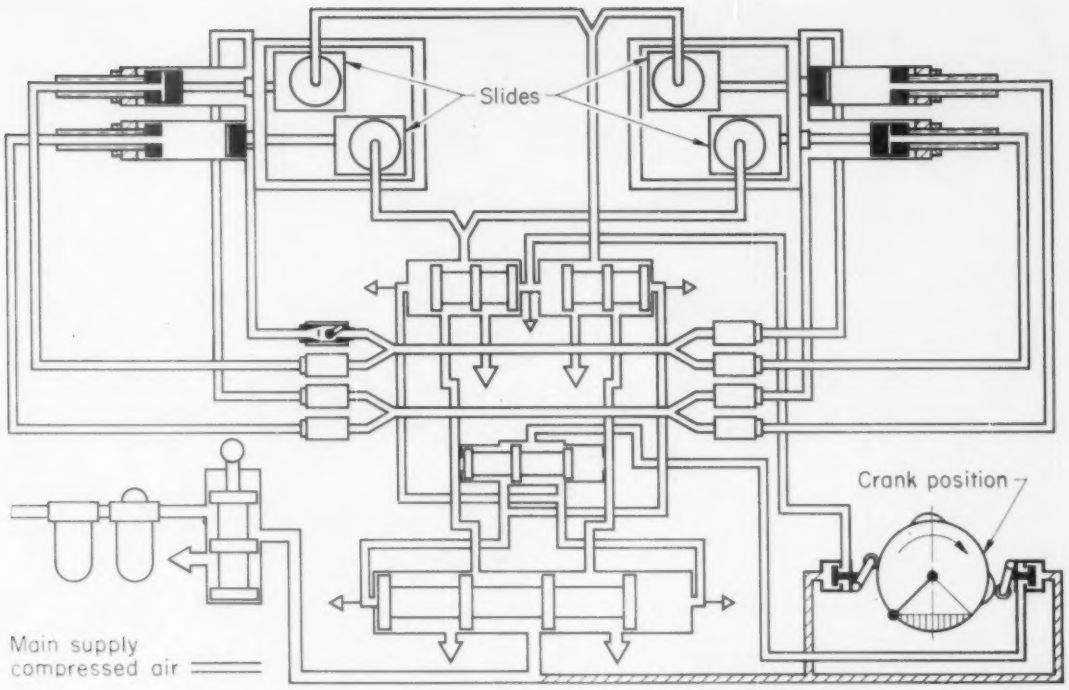
Fig. 2. Four phases of stock advance. Crosshatching on circular pads denotes gripping pressure.

sons. The first is to insure proper registration of the pilots without part distortion. Virtually all progressive dies have pilots to position the strip at each die station. These pilots have tapered points that enter pierced holes in the strip before die engagement, thus correcting any misalignments in the stock. There are instances, however, when piloting does not accomplish this purpose. If workpiece stock is thin, or if the error in feed length is excessive, hole distortion from pilot pickup results. This distortion is a guarantee that the workpiece is out of position during die closure. Thus, the pilot cannot be regarded as a cure-all for inaccuracies in stock advance.

A second reason for the importance of accurate feed length is that in some cases part design does not lend itself to the use of pilots. For example, if the part does not have pierced holes that can be utilized for piloting, special holes for this purpose must be pierced beyond the outer limit of the part. This means that excessively wide stock must be purchased for the job. If a relatively accurate feed unit is used, however, it is sometimes possible to omit pilots and use narrower stock.

Adaptability of a press feed unit depends on whether it can perform efficiently with all jobs that fit the press. Not all dies are mounted on the bolster—some are set on parallels—and not all are mounted in the same horizontal position.

Twin Slide Design: To overcome deficiencies in accuracy and adaptability of conventional press feeding units, a European company has designed and built the feed unit illustrated in *Fig.* 1. Stock advance is accomplished in this unit by two oscillating clamps that seize and advance the strip in alternate movements. Thus, while one set of clamps is advancing with the stock, the other is returning to start position, *Fig.* 2. Unlike press-actuated feed units, the twin slide design does not use crankshaft motion as a source of motive power. Instead, pneumatic cylinders actuated by cams mounted on the crankshaft are utilized for all slide movements. This provides greater accuracy while allowing use of a greater percentage of the press cycle for strip transfer. In shaft-actuated movements only that portion of the cycle between upper dead center and the beginning of die engagement can be used for part transfer. In the twin slide unit the entire portion of the crank cycle minus the portion required for die



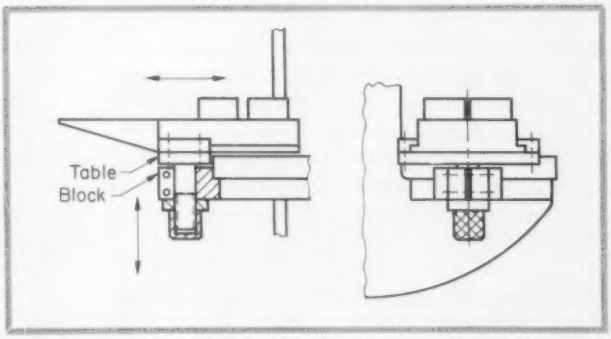


Fig. 3. (above) Schematic diagram showing cylinders and pneumatic circuitry of twin slide feed unit.

Fig. 4. (right) Method of attaching unit to press bed. Vertical adjustment is obtained by screwing table up or down in block.

engagement can be used for stock advance.

Movements of the twin slide cycle are divided into four distinct phases. These are:

PHASE 1. END OF DIE ENGAGEMENT. Clamps *A* close and start strip transfer while clamps *B* open and return

PHASE 2. START OF DIE ENGAGEMENT. Feed stroke is terminated but clamps *A* continue to hold stock during die engagement

PHASE 3. END OF DIE ENGAGEMENT. Clamps *B* close and start strip transfer while clamps *A* open and return

PHASE 4. START OF DIE ENGAGEMENT. Feed stroke is terminated but clamps *B* continue to hold stock during die engagement.

Feed Unit Construction: Design of the unit resembles that of a frame in which two slides move in opposition along guide rails, *Fig.* 3. The air cylinders that move the slides are mounted in the frame and the cylinder pistons alternate between two stops. The stop nearest the tool is fixed and is placed as close to the unit as possible to minimize overhang. The outer stop is an adjustable pad through which air is introduced to the cylinder. Corrections in stroke length and maintenance of constant waste volume in the cylinder can be made by screwing this pad in or out. This reduces air consumption on short strokes while permitting rapid movements in the slides.

In operation, stock is led through the unit by guides, a design that insures minimal difficulty in inclined presses. Funnel type guides at either side of the press tool maintain stock alignment during stamping.

The manner in which the twin slide feed unit is attached to the press is shown in *Fig.* 4. Vertical adjustments of the unit are obtained by simple

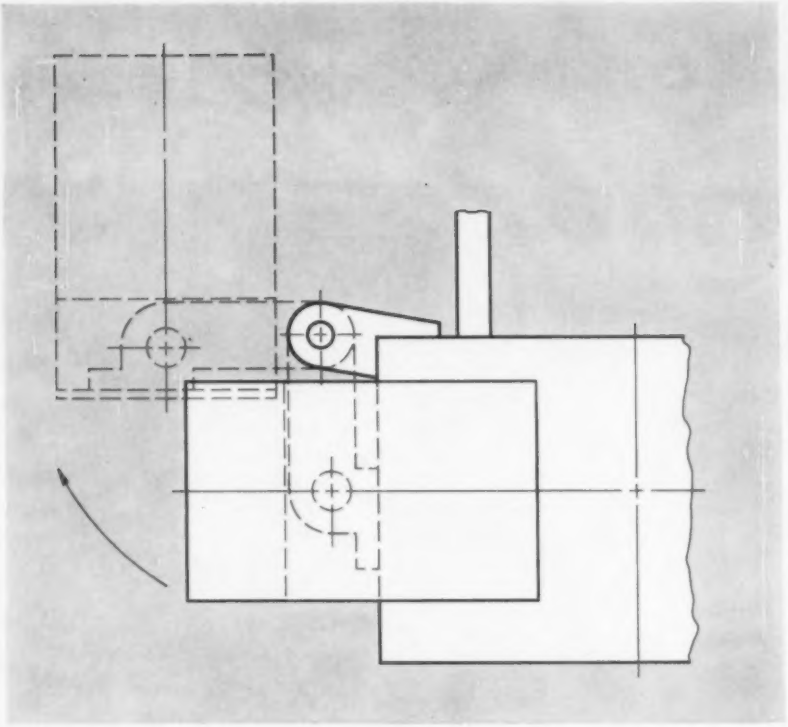


Fig. 5. Swinging arm design for retraction of unit. Arm takes the form of the block shown in *Fig.* 4.

adjustment of a screw. Horizontal adjustments are obtained by screws with which the unit is secured to its mounting plate.

Because some of the larger presses must be operated manually on occasion, provision is made for swinging the entire unit away from the press when the need arises. Design of the swinging arm is shown in *Fig.* 5.

Advantages: On certain jobs, the application of the twin slide unit to a stamping press has numerous advantages. For one, its accuracy has proven superior to that of many commercial feed units even at extremely high rates of speed. In common with commercial units, however, its accuracy tends to decrease as speed and progression increase.

Second, the fact that two units are used—one at either side of the die—makes it possible to feed extremely flexible stock. In addition, it makes possible the complete consumption of the stock, an impossibility with single unit feeders.

Third, in many cases its use enables die designers to dispense with piloting as a method of part positioning. It is also possible to alternate feed lengths between long and short strokes, an impossibility in piloted dies.

Probably the greatest advantage of this type unit is its versatility. Adjustable in three dimensions, adaptable to a wide variety of speeds and feed lengths, and easily removed for manual operation, it gives the press greater productivity without limiting the types of jobs it can do.

New Alloys Answer Missile Problem

Demands from missile makers for low density materials with greater strength-to-weight ratios and the capability of operating at high temperatures have led to the development of a class of new nonmagnetic alloys called Nitinol. Based on the intermetallic compound TiNi, these alloys are corrosion resistant and can be hardened to R_C62. Their toughness increases as temperatures decrease, yet they are suitable for use up to 1200 F. Specific gravity of the alloys is 6.45. They have a high mechanical vibration capacity at room temperature which decreases as temperature increases. Developed by Navy scientists at the U. S. Naval Ordnance Laboratory at White Oak, Md., Nitinol has potential use in missile and aircraft components, tools for mine disposal and other underwater ordnance work, temperature sensing devices, and chemical handling equipment.

REFERENCE SHEET

forward extrusion of STEEL

SUCCESSFUL forward extrusion of metal depends largely on the attention given to tool design. Because each tool must be engineered around certain design parameters, it is impossible to tabulate all possible designs for any given extrusion. It is possible to list certain rules which, if followed, will enable the designer to accomplish a desired extrusion with a minimum of difficulty.

Extrusion Die Types: Two types are possible —angular and radial. Of the two, radial extrusion is preferable if part design permits its use. Generally, the inclusion of a radius in an extrusion die improves the grain structure of the metal, minimizes galling, lowers tonnage requirements and prolongs tool life.

In either type of forward extrusion the entrance diameter should be 0.002 to 0.008 inch larger than the stock diameter. Percentage of stock reduction is the governing factor in determining oversize since small reductions require relatively little clearance but large reductions will require the full 0.008 inch.

Entrance length of the die should range from ¼ to ½ stock thickness, depending on how well the stock is guided. If guiding is good, entrance length can be kept on the small side. In all cases it should be remembered that stock guiding is a critical factor.

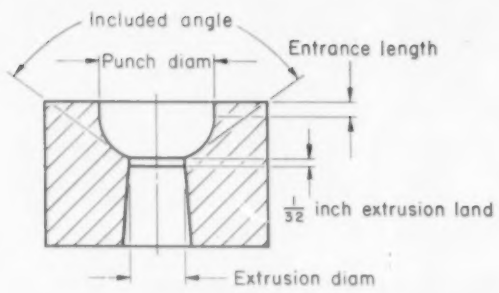
Length of extrusion land has an important effect on part straightness and on pressure requirements. As the length of the land increases, extrusion pressures also increase and part straightness improves. Normally, the extrusion land is from 0.020 to 0.050 inch long. Clearance below the land should be large enough to eliminate any possibility of drag on the passing extrusion.

Included extrusion angle should vary between 30 and 50 degrees for normal forward angular extrusion. In forward radial extrusion this angle is generally maintained at approximately 90 degrees, although it can vary slightly depending on the percentage of reduction the die is expected to accomplish.

Tool Material: Inserts for forward extrusion should be carbide or wear-resistant steel. Carbide is preferable but in many cases 18-4-1 high-speed steel will suffice. If made of steel, the inserts should be hardened to 60-62 R_C.

In all assemblies the inserts must be secured in their cases with a 0.004 to 0.007-inch interference fit. The assemblies are made by freezing the inserts and heating the cases. Care must be exercised to assure that heating temperatures do not exceed the draw temperature of the case material.

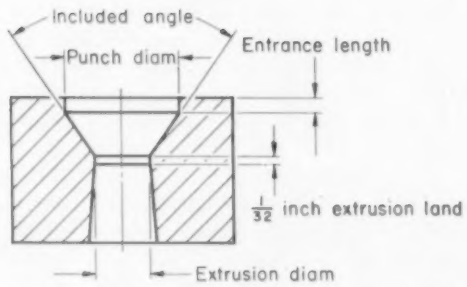
Extrusion Types Compared: To evaluate the two types of extrusion, National Machinery Co., Tiffin, Ohio, has tabulated the results of test runs on both types. Material used in the test was 0.697-inch diameter 1010 steel. The results obtained are useful, because they show the reactions of both types of dies under 14 similar conditions of part



design. They also demonstrate the variations in extrusion pressure as the entrance angle varies and as the percentage of reduction in cross sectional area increases. The only variable not tested in this program is length of extrusion land. This dimension was held to $\frac{1}{32}$ inch throughout the test.

Straight Angle Extrusion Die

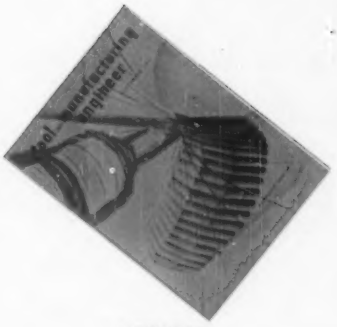
Punch Diameter (inch)	Extrusion Diameter (inch)	Reduction in Area (%)	Extrusion Angle (deg)	Entrance Length (inch)	Length of Extrusion (inch)	Average Extrusion Pressure (psi)
0.705	0.538	40	30	0.062	1.188	60,580
			60	0.228	1.125	74,400
			90	0.289	1.000	87,750
			120	0.324	1.125	112,500
			160	0.342	1.000	106,100
	0.440	60	30	0.062	1.500	54,550
			60	0.311	1.312	41,300
			90	0.408	1.125	128,600
			120	0.464	1.000	146,300
			160	0.517	0.937	163,900
	0.310	80	30	0.062	2.125	228,250
			60	0.455	1.375	201,000
			90	0.600	1.125	202,500
			120	0.683	0.750	223,000



Radius Type Extrusion Die

Punch Diameter (inch)	Extrusion Diameter (inch)	Reduction in Area (%)	Extrusion Angle (deg)	Entrance Length (inch)	Extrusion Radius (inch)	Length of Extrusion (inch)	Average Extrusion Pressure (psi)
0.705	0.538	40	60	0.062	0.619	1.125	57,700
			90	0.170	0.284	1.062	70,700
			120	0.226	0.166	1.000	81,900
			160	0.272	0.100	1.000	109,000
			180	0.287	0.083	1.000	109,000
	0.440	60	60	0.062	0.954	1.500	106,800
			90	0.231	0.437	1.437	78,700
			120	0.353	0.256	1.375	110,250
			160	0.387	0.155	1.188	152,250
			180	0.408	0.132	1.062	167,900
	0.310	80	60	0.062	1.470	1.875	188,750
			90	0.322	0.673	1.375	191,000
			120	0.456	0.394	1.250	191,500
			160	0.563	0.238	0.812	223,000

ENGINEERING MANAGEMENT

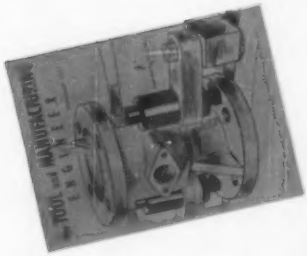


METHODS

astme in action

INSPECTION

TME's field editors—a panel of experts in every phase of manufacturing covered by the magazine.
Story on Page 95.



TOOLING

MACHINE DESIGN

MATERIALS

PROCESSES

news

news section

features

Eyes and Ears of the Magazine 95

Foundation for Progress 96

Board Meets in Toronto 97

Semiannual Spotlight 98

Wisconsin Underscores Competitive Manufacturing 100

Members in the News 101

Kokomo Hears Story of Productivity 102

Spring To Bring New Publication 102

chapters

Ann Arbor Area 104
Baltimore 105
Calumet Area 104
Canton 105
Danbury 105
Dayton 105
Des Moines 105
Elmira 105
Indianapolis 103
Kokomo 102
Long Island 103
Milwaukee 105
North Shore 105
Northern Massachusetts 104
Peoria 105
Racine 100
Richmond 105
Rockford 103
Santa Monica Bay Area 105
Seattle 104
South Bend 105
Temple University 105
Worcester 105

Eyes and Ears of the Magazine

EVERY INDUSTRIAL EDITOR dreams of flanking his staff with an army of specialists to act as his magazine's eyes and ears in all pertinent industries throughout the country.

Every editor, that is, except John W. Greve of THE TOOL AND MANUFACTURING ENGINEER.

For many years now Editor Greve's staff has been ably assisted by an international brigade of manufacturing specialists called field editors. Men who hold key positions in all the industries where tool and manufacturing engineers work, the field editors cover ground that no staff—no matter how large—can cover.

Besides reporting new engineering developments and sometimes actually writing technical articles, TME's field editors serve as a link between industry and the magazine so that readers may be kept informed on topics that are of most interest in the field. Since each is an authority on some specific aspect of manufacturing, individual field editors are often consulted on matters connected with their particular specialty.

The list of field editors, revised and enlarged each year, presently comprises 81 engineers and manufacturing executives. Representing 16 states, Canada and Scotland, the group includes many prominent leaders in the Society: seven past presidents as well as the current chief executive of ASTME; nine members of the board of directors; and at least one representative of every Society committee.

When classified according to their subject interests, the 81 field editors form panels of from 30 to 40 experts on each of the major subject areas covered by the magazine. These broad subject categories, illustrated on the cover of this month's News section, are processes, methods, inspection, materials, engineering management, tooling and machine design.

An invaluable asset of the magazine, the field editors play a vital role in maintaining THE TOOL AND MANUFACTURING ENGINEER's position as a leader in its field.

1961-1962 Field Editors

Justus L. Alexander
B. H. Amstead
L. B. Bellamy
George C. Bennett
G. Ben Berlien
J. Albert Bircher
Duane H. Brighton
Charlton A. Brown
Eric I. Browne
Melvin G. Burdett
Robert G. Carson, Jr.
Arthur Cervenka
Ralph L. Chrissie
George H. Churchill
Lester M. Cole
H. E. Collins
Conrad Corsini
Joseph A. Crane
Glenn L. Crippen
Joseph P. Crosby
Carl A. Darger
Leon DeVos
Paul Dillberg
L. E. Doyle
R. A. Edgcomb
Roy E. Erickson
Victor J. Fitting
William H. Forbes
V. H. Gallichotte
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Ben J. Hazewinkel
E. C. Holmke
O. S. Hulley
Sidney B. Jeffreys
Nicholas W. Juliani
Erwin J. Kaiser
John W. Kellogg
Edgar M. Ketchie
Rayburn M. Knabe
Michael R. Lettieri
Arthur Mackmann
Philip R. Marsilius
Sheldon Meyers
William Moore
William Moreland
Herman Muehlbauer
W. B. McClellan
Robert E. McKee
Howard C. McMillen
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Karl A. Nowak
H. B. Osborn, Jr.
Harry A. Paine
S. H. Parsons, Jr.
Lewis C. Pascoe
Joseph L. Petz
Edwin B. Phillips
Roy Price
Rudolf Regen
Harold Rhodes
James C. Rodgers
Wilbur D. Russell
A. O. Schmidt
Dominic R. Scolaro
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M. C. Shaw
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C. H. Thuman
Harry J. Todd
Paul W. Vierling
Lawrence A. Wacker
Walter F. Wagner
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R. N. Wiley
Otto W. Winter

Semiannual Report:

Foundation for Progress

By Harry E. Conrad
ASTME General Manager

AFTER TWO YEARS of concentrated study and consideration by the Long Range Planning Committee, the original concepts and purposes of the Society as stated in the Constitution have not been altered or changed in any manner. As a matter of fact, a major recommendation in the committee's conclusions pointed out that the Society's direction and primary thrust must be a vigorous program of accomplishment toward achieving the purposes for which the Society was founded.

As the new activities recommended by the long range planners go into effect, it is essential that every member of ASTME understand the objectives which these activities are to accomplish—and understand that they are designed to increase the vitality and the effectiveness of the Society in his behalf. In the final analysis it will be the members' acceptance and support that will determine the degree of success and accomplishment of the objectives for any given activity. Thus the membership must be apprised of the job to be done, the reasons for doing the job, and the manner in which they as individuals must perform if the Society as a whole is to progress.

Society Purposes Spelled Out

The broad concepts and reasons upon which the Society came into being 30 years ago are clearly set forth in the Constitution:

> "To be an operating institution for the advancement of scientific knowledge in the field of tool and manufacturing enginering; to provide the means and methods of applying such knowledge in practice and in education; and to promote and engage actively in research, writing, publishing and dissemination of knowledge within said field."

These purposes have not changed one iota since their conception, nor should they change as long as man exists on this earth or elsewhere. The wisdom of the founding fathers in establishing them is evidenced by the Society's 30 years of progress in contributing to the welfare of mankind.

It is apparent from the foregoing precepts that the Society was not conceived as a commercial organization, but rather as a creative institution for the advancement of the science of tool and manufacturing engineering. The member, irrespective of his individual interests, is obligated to recognize that the aims and objectives of ASTME must take precedence. His reason for becoming part of the Society must thereby have been induced by his desire to contribute individually and collectively to the science of tool and manufacturing engineering and to the profession wherein his primary interests are associated. Actually, the benefits derived by the individual directly are incidental. What and how much he contributes determines the degree of personal success and satisfaction that is provided by his chosen profession.

Professional Status Is Basic

The philosophy of the Society's professional status should be at the basis of every activity, every program. All men entrusted with the offices of leadership should be made aware of this philosophy and should be charged to carry out their activities within this framework. In this way the individual ASTME member will be given ample opportunity to fully execute his responsibilities.

This basic philosophy aimed at creating, promoting and achieving enhanced professional status for the Society does not in any way work at cross purposes with the chapter objectives. It is the chapters' responsibility, because of their closeness to the local situation, to draw down into finer focus the member's individual problems and requirements. It is vital that the chapters maintain this responsibility so that the over-all Society program can be kept in proper balance and perspective. Effective communication throughout the entire membership is the golden key so necessary as the Society passes another milestone in its forward progress toward its full potential.

The primary focal point is the member; the charge is to enhance Society prestige; the goal is to attain for tool and manufacturing engineering a professional status of the first magnitude.

Board Meets in Toronto

OPENING the Semiannual Meeting of the ASTME Board of Directors in Toronto last October, President Wm. Moreland commenced a lengthy agenda of Society business with an apt reminder of the personal obligation of every member to promote the idea of professionalism in every circumstance.

"A professional," said the president, "is a person who displays excellence in everything he does. He abhors mediocrity and constantly strives to give the full measure of his talent to each facet of his daily life."

While the Society can do much to develop the stature of a tool and manufacturing engineer as a professional, emphasized Moreland, the primary obligation belongs to the member. His skill in creative manufacturing must be matched or excelled by his worth as a citizen.

Meeting in Toronto's Royal York Hotel, the directors spent two-and-a-half days covering old and new business as well as a bulging volume of committee reports. Among the most significant results of the meeting is a $861,400 budget for committees, departments and projects in the fiscal year 1962. Uppermost in the directors' minds while approving this budget was the prudent advice of Treasurer Albert Underwood. "In light of expanding programs and building of new facilities, available funds can easily be dissipated unless we are cautious in our spending," he warned. "All new activities, as well as the old, should be critically examined to determine if they are necessary for the Society's development of long-range goals."

On the recommendation of the House of Delegates the board voted to drop the word "national" from National Headquarters. It was further decided that, whenever possible, "national" be eliminated from Society literature.

The Building Subcommittee reported that Leonard G. Siegal, A.I.A., of Detroit has been selected as the architect for the new Headquarters structure. Estimating that the Headquarters staff will number from 140 to 160 employees in 1975, the subcommittee concluded that the administrative building should contain a gross total area of 36,000 sq ft. The exact site of the facility is as yet undetermined; however, the location will be within 40 miles of downtown Detroit. Completion date for the structure is 1963.

After considering the recommendations of the International Operations Committee, the directors agreed that offshore chapter activity should be expanded but that ASTME should remain the "American Society," with no sectional divisions, as such, in other geographical areas. No student chapters will be chartered outside the United States, said the board, and chapters will not be permitted in countries whose governmental policies are in conflict with those of the U.S. Offshore members and chapters are to receive complete member and chapter services and are entitled to all rights and privileges of representation. In addition, the Society will continue to accept members-at-large from any country with which the U.S. has diplomatic relations.

Elected by the board to the Annual Nominating Committee for Directors for 1963-64 were Wayne Kay, Walter B. Kiefer, Sidney Jeffreys and Ray Meckley. Chairman of the committee is Vice President Verne Loeppert. Appointed as the Annual Nominating Committee for next year's officers were Past President Dale Long, chairman; Directors Robert Johnson and George Bennett.

In other actions at the Toronto meeting the board endorsed an affiliate membership for ASTME in the Engineers Joint Council and appropriated funds for the support of the Junior Engineering Technical Society. Funds were also granted to the Membership Committee for a nationally coordinated membership campaign to assure continuation of Society growth. The Standards Committee was authorized by the directors to advise the National Bureau of Standards of ASTME's interest and willingness to cooperate in the proposed study of the practicability of U.S. adoption of the Metric System.

NEW DIRECTORS sworn into office at the Toronto meeting give a thorough going-over to committee reports before casting their votes on the recommendations submitted to the board. Standing left to right are Ralph L. Chrissie, Francis J. Sehn and Frederick Preator; seated left to right are George C. Bennett, Robert M. Johnson and Carl A. Darger.

ENGINEERING PAPERS presented at the three Semiannual-Meeting Techtours last October dealt with economy in plant planning, in design and engineering and in production. Here a speaker at the opening Techtour, Canadian Acme's Ian Leslie, describes the complete reorganization of two-thirds of his plant's manufacturing operations. Later, the group visited the plant to see the reorganization results for themselves.

PAST DIRECTORS attending the Semiannual Banquet in Toronto received honorary pins from President Wm. Moreland for their able and devoted service to the Society. Joseph L. Petz (above), who served as director for five years, has also spent seven terms on the ASTME Editorial Committee. A member of the Board for one term, Toronto Host Committee Chairman Bruce Fairgrieve (below) has served on both the Finance and Public Relations committees. That's General Manager Harry E. Conrad in the foreground of the pictures.

SEMIANNUAL

ENGINEERING TOURS depicting the operations explained in the Semi-annual-Meeting papers gave registrants like Alex E. LaBrash (left) a first-hand look at manufacturing economies in five Toronto plants. The popularity of the combined engineering paper-tour program was well evidenced in a total attendance of 241 at the Toronto meeting's three Techtours.

SPOTLIGHT

Machine tool obsolescence means more than just the physical wearing out of a machine tool, points out Harold Kippers during a technical session at the Wisconsin Council of Chapters' On-Campus Conference.

Wisconsin Underscores Competitive Manufacturing

WISCONSIN ENGINEERS underscored the most modern manufacturing processes and equipment during a recent conference in Racine.

Held at the newly built Dominican College on the shores of Lake Michigan, the Second Annual On-Campus Conference of the Wisconsin Council of ASTME Chapters drew some 100 registrants for a highly successful meeting on manufacturing for competitive markets. The full-day program, including four technical sessions, special ladies' activities and an evening banquet, opened with a talk by General Chairman Jack Kellogg, member of the Society's Editorial Committee and past chairman of the host chapter Racine.

Leading off the technical sessions, Lloyd A. Hamilton of American Motors Corp. noted that automation got its start when man invented the wheel to lighten his work load. To demonstrate the advanced stages of automation today, Hamilton depicted the completely automatic production of a gasoline tank —from a flat piece of steel to an assembled component of an automobile body.

In a talk titled "The Dimensions of Accuracy in Measurement," W. J. Darmondy of The Sheffield Corp. reviewed five methods of measurement: mechanical, pneumatic, electrical, optical and radiative. The old standard of length, a platinum-iridium bar kept in France, was superseded in September by the orange red line of crypton 86, said Darmondy.

Luncheon speaker David A. Schrom, Society vice president, urged his audience to spend full time on engineering and leave the technical details to technicians. Toastmaster during the lunch hour was Gilbert E. Seeley, ASTME education director.

The afternoon sessions of the meeting brought a discussion of machine tool obsolescence by Kearney & Trecker Corp.'s Harold Kippers. In addition, Fred Bigsby of A C Spark Plug, Div. of General Motors, spoke on "Value Engineering," pointing out the importance of evaluating present production methods with an eye to reducing costs and remaining competitive.

While their husbands attended the conference, the ladies were entertained with a luncheon and fashion show as well as a tour of the famous S. C. Johnson & Son offices, designed by the late Frank Lloyd Wright.

At the closing banquet, ASTME Vice President H. Verne Loeppert introduced the guest speaker, Arch Ely, executive director of Wisconsin Public Expenditure Survey. Discussing the basic tax problems of the state, Ely emphasized the effect of an increasing population and the changing economic and political conditions on the tax situation.

Members in the News

DAVID A. SCHROM, vice president of the Society, has joined The DeLaval Separator Co., Poughkeepsie, N. Y., as manager of manufacturing. In this capacity he is responsible for manufacturing and industrial relations. Prior to joining DeLaval last month, Schrom was works manager of the York Div. of the Borg-Warner Corp., York, Pa.

Toledo chapter members KENNETH F. KOEGLER and JOHN W. THEES have assumed new positions with Doehler-Jarvis Div. of National Lead Co. Koegler, new assistant to the division manager, has been with Doehler-Jarvis since 1950. Thees will assume the duties of plant manager Toledo Plant 2. Since joining the firm in 1929, he has served as chief inspector, works manager and division production manager.

Past president of ASTME and director for 13 years, HAROLD E. COLLINS recently assumed the duties of director of licensee manufacturing services at Hughes Tool Co. In his new position he will act as technical consultant to the companies licensed to manufacture Hughes products. Since joining the firm in 1919, Collins has served as toolroom foreman, plant superintendent, and manager of process engineering. Immediately prior to his new appointment he was manager of overseas manufacturing.

Macomb chapter member JOSEPH D. STANK has been elected vice president of The Ladendorf Co. in Detroit. Prior to joining Ladendorf in 1960 as sales engineer, he was sales and Detroit district manager of Allied Products Div. of Motch and Merryweather Co.

ARTHUR T. CLARAGE of Calumet Area chapter has retired as president of Columbia Tool Steel Co. in Chicago Heights, Ill. He began his career with Columbia as a chemical laboratory assistant in 1914 and later served as assistant general manager and general manager until 1925 when he was elected president of the tool steel firm. Clarage is continuing as chairman of the board at Columbia.

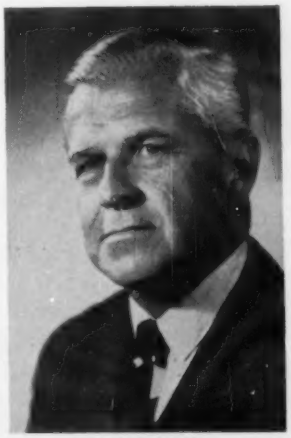
For his service to the voluntary standards movement in the United States, LOUIS F. POLK was awarded the American Standards Assn.'s 1961 Howard Coonley Medal. Polk, board chairman of The Sheffield Corp. and vice president and group executive of The Bendix Corp., received the gold medal and citation at ASA's 12th National Conference on Standards. He has been active in the development of American standards since 1941 and currently participates as a policy correspondent for the U.S. on the American-British-Canadian Engineering Unification Conference. He was a delegate to the 11th General Conference on Weights and Measures which adopted a new standard of reference for linear movement. Polk, a member of ASTME's Dayton chapter, is past president of both the National Machine Tool Builders Assn. and the American Ordnance Assn.

CHARLES R. BENDER was recently appointed executive secretary of the National Tool, Die and Precision Machining Assn. He has been assistant executive secretary of that society for the past 26 years. Bender is a member of ASTME's Cleveland chapter.

Detroit chapter member DONALD J. WALLACE has been appointed vice president of sales at Wheel Trueing Tool Co. Formerly vice president of manufacturing, he joined the Detroit firm as a trainee in 1933.

Arthur T. Clarage

Harold E. Collins



Louis F. Polk

Members of local chapters of ASTME and SDCE examine the sunburst and other components of The DoAll Co.'s display, "The Story of Productivity." Attending the Kokomo program were some 90 engineers.

Kokomo Hears Story of Productivity

MAJOR EVENTS that began with the Industrial Revolution and brought man to his present state of material welfare were recently highlighted in a presentation before members of Kokomo chapter and their guests, the local group of the Society of Die Cast Engineers.

The program, sponsored by The DoAll Co., and entitled "The Story of Productivity," travels throughout the country and will be seen by nearly 20 ASTME chapters. It is primarily a display built around a "sunburst" which records in 10 classifications all of the major events that helped usher in man's age of abundance. Flanking the sunburst are display tables and panels, and above eight of these are life-size busts of great inventors. The tables contain exact replicas or models of inventions that made major contributions toward man's progress.

Lecturer for the Kokomo program, C. G. Schelly, pointed up how the foundation was laid for today's era of high productivity. Using color slides, he examined the strides made in various areas of human progress since the turn of the century. A second talk explained to the group the United States' present competitive position and the need for increased productivity in American plants both now and in the years ahead.

Spring To Bring New Publication

KEEPING ABREAST of Space-Age developments in the machining of superalloys, the ASTME Technical Publications Committee has announced the forthcoming publication of a new Society book, *Machining with Carbides and Oxides.* A number of contributors, many of whom are ASTME members, assisted in the preparation of this book by contributing information based on their research. Since these men are among America's foremost authorities in the field of metalcutting, the new publication promises to be regarded as a definitive work on one of the most important aspects of tool and manufacturing engineering.

According to the committee, the scope of this book is not limited solely to the carbides and oxides, although special emphasis is given to those materials. Other cutting tool materials are discussed from a comparative point of view. Carbide tooling and operations will predominate, but also included will be all the recent proved findings on the efficient use of the oxides.

Publication of *Machining with Carbides and Oxides,* scheduled for late spring of 1962, will mark the Technical Publications Committee's second major achievement for the forthcoming year. Scheduled for publication in January of 1962 is the Society's *Handbook of Fixture Design.*

Seminar To Be Repeated

The outstanding success of the Society's latest Creative Manufacturing Seminar—"Prototype and Short Run Tooling Methods," held in New York on Nov. 8-9—has called for a repeat of the program next January.

Several weeks prior to the November seminar, registration soared to 180, necessitating a cutoff of further registrations in order to maintain the quality of the program. In the intervening weeks before the seminar, over 100 requests for registration had to be turned away. Thus, the Engineering Conference Committee has scheduled a repeat of the program for Jan. 16-17 at the Belmont Plaza Hotel in New York. Registration information is available from Conference Director Leslie S. Fletcher at Society Headquarters in Detroit.

Defense from the Sea

LONG ISLAND, N. Y.—"Our enemies are here, not in outer space," said Lieutenant Commander George Berg in a recent speech to Long Island chapter. America should not worry so much about the fringe of outer space, but should concern itself more with the fringe of the sea, he warned.

Berg then told just why sea power is so important. Water covers 70 percent of the earth's surface, he said, and this country relies heavily on transportation across these waters—transportation of imports needed to manufacture everyday necessities plus the tools of defense, and transportation of troops with an average of 15 tons of supplies per man. To continue this movement, the U.S. continues to need strong naval forces.

In the case of an all-out nuclear attack, declared Berg, atomic-powered submarines carrying Polaris missiles would instantly retaliate. These invisible mobile missile bases could launch an attack from points unknown to the enemy and then move to new locations to avoid being tracked. Berg illustrated the power of America's underwater defense system by telling his audience that two atomic-powered subs command more destructive power than all forces in the history of war. This includes even the A-bombs of World War II. *—Robert Wagenseil*

Commander George Berg as he told members of Long Island chapter about the pitfalls of neglecting American sea power in favor of outer space conquests.

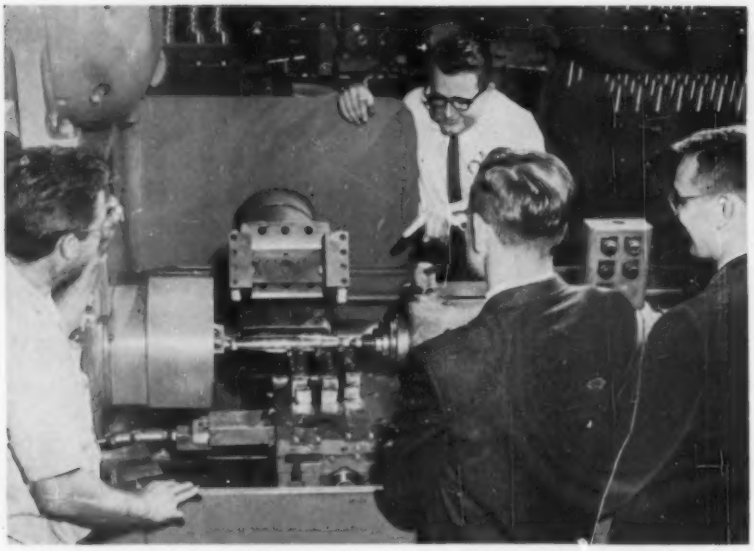
Temperature Influences Numerical Control

INDIANAPOLIS, Ind.—Room temperature for precision tape-controlled boring machines should vary not more than one quarter of one degree, said C. R. Hibbard in a technical speech to 75 members and guests of Indianapolis chapter. Such a slight variation in temperature is maintained only in temperature-controlled rooms although a few control factors relating to temperature change can be incorporated into the boring machine itself.

Hibbard, who is with Fosdick Machine and Tool Co., presented Chapter 37 with a program on numerical control in precision boring and described its application in a conventional jig borer. The result of this application, he said, is a precision boring machine incorporating a mechanical measuring, electromechanical positioning and an electromechanical remote-control system to provide three-axis control. *—Loren V. Hunt*

Rockford Members Tour Besly-Welles Plant

ROCKFORD, Ill.—An afternoon plant tour of Besly-Welles Co., was part of a program recently held by members of Rock River Valley Purchasing Agents Association and ASTME Chapter 12. That evening the combined groups gathered to hear Dean Barnlund, professor at Northwestern University, speak on a communications problem of deep interest to both societies—talking past each other. *—H. W. White*



Ann Arbor Sponsors Tour at Albion

ANN ARBOR AREA—Albion Malleable Iron Co., was the scene of a recent Ann Arbor Area chapter plant tour. Albin K. Gotuatas (second from left), general foreman of the firm's ordnance machining shop, explains a plant operation as an operator and two Chapter 79 members look on.

—Harry Farsakian

Calumet Hosts Bell

CALUMET AREA—W. T. Wiedeman (right), of Illinois Bell Telephone Co., and E. W. Menke, Calumet Area chairman, stand beside a map used to demonstrate how America's defenses would operate following an enemy attack. Wiedeman, who recently reported to Chapter 112 on this country's defenses, presented working models of the DEW line and White Alice installations. ***—Thomas S. Garner***

Space Meeting at Seattle

SEATTLE, Wash.—Cecil Lacy (second from left) of Boeing Airplane Co., recently told Seattle members of some of the problems in the development of the Dyna-Soar Space Ship. Bill Smith (right) Seattle chairman, greets Lacy while Forest Swan (left), vice chairman, greets Web Marshall, coffee speaker for the evening. Included in Lacy's presentation was a 10½-foot-long model of the space craft. ***—Ray Clift***

special events

ASTME Seminar "Electric Machining and Forming"	Dec. 6-7 1961	Statler Hilton Hotel Hartford, Conn.
ASTME 1962 Engineering Conference	May 7-11 1962	Statler Hilton Hotel Cleveland, Ohio
ASTME 1962 Tool Exposition	May 7-11 1962	Statler Hilton Hotel Cleveland, Ohio

Affiliate Support Honored

NORTHERN MASSACHUSETTS—A program designed to express recognition and appreciation has been initiated by Northern Massachusetts Chapter 100. Objects of this honor are the affiliate members who have made possible, through their supporting memberships, the chapter's scholarship and educational programs. At each meeting of the chapter an affiliate will be invited to give an exhibit of the company's product plus a short talk. The company will then be presented with the Society's new official Affiliate Member Plaque. ***—Richard R. Hollien***

Danbury Tours Eagle Pencil

DANBURY, Conn.—Inspecting facilities at Eagle Pencil Co. are Danbury chapter officers Harold R. Jarvis, Sr., first vice chairman; Wilbur A. Spafford, chairman; and Milo Nagy, chairman of constitution and bylaws. Eagle Pencil was recently toured by members of the Society's local chapter. *—Ebbie Thompson*

Show how YOU did it!

Enter the 1961 Gadgets Contest now!

To enter the contest is to:

- Use some of your ingenious ideas
- Win some prize money or any one of ASTME's publications
- Show someone else how to do it
- Make a contribution to THE TOOL AND MANUFACTURING ENGINEER
- Make a contribution to your profession
- Get an honorarium for your published gadget
- HAVE FUN!

Submit those entries before Dec. 21.

This is the final call!

Interest Runs High at Chapter Exhibit

SOUTH BEND, Ind.—Unaware of the photographer behind them, several South Bend members focus their attention on a display of bearings, one of the 30 industrial exhibits featured at Chapter 30's Manufacturers' Night. *—Donald H. Major*

Reports in Brief

Northeast

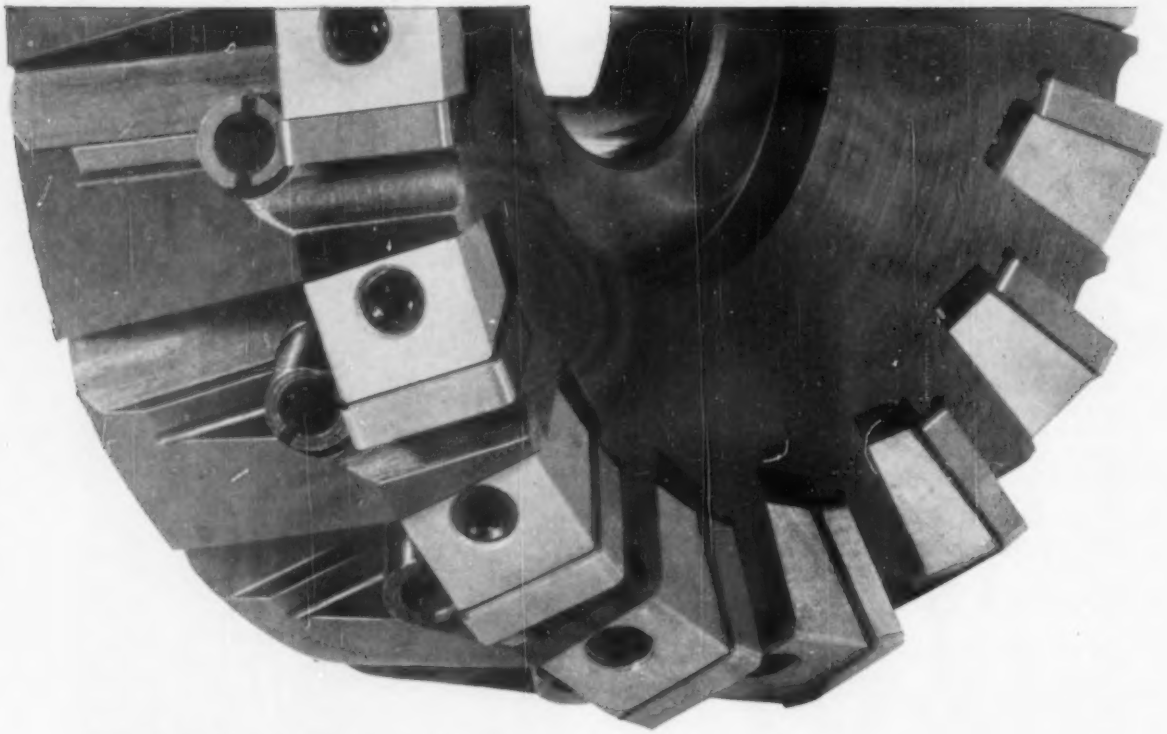
In an attempt to acquaint city officials with ASTME, ELMIRA chapter invited Children's Court Judge Daniel J. Donahoe to its first meeting of the season. Donahoe outlined the work of the court and spoke on legislation, power, parents, police protection and welfare agencies. . . . BALTIMORE chapter recently heard Hans A. Nyenhuis speak on the working and use of the electron beam in welding, milling and drilling of various metals, including the exotics. He explained how it is possible in some metals, to drill holes of 0.0005-inch diameter. . . . NORTH SHORE chapter also had a recent technical program on electron beam welding. Robert Schnubel, senior project engineer at Hamilton Standard, told the group that this method of welding has many advantages over conventional methods because it requires less heat. . . . Prime contractors for the M-14 Rifle, Rochdale Div. of H & R Arms Co., played host to WORCESTER chapter during a recent plant tour. . . . At their first fall meeting members of TEMPLE UNIVERSITY student chapter heard Edward Flekenstein, the school's director of guidance, speak on the benefits of belonging to professional organizations such as ASTME.

West Coast

SANTA MONICA BAY AREA chapter ushered in its fall season with a program on the filament winding of pressure vessels. Richard Gorcey from Rocketdyne Co.'s Solid Propellants Div. was the program's featured speaker.

Midwest

Fisher Governor Co. opened its doors to DES MOINES chapter for the group's first fall meeting. Some 95 members and guests toured the firm's plant where many various control valves are manufactured. . . . RICHMOND Chapter 66 recently visited Ford Motor Co.'s plant at Lima, Ohio, where they saw automobile engines roll off the assembly line at the rate of 3200 per day. . . . Variety keynoted MILWAUKEE chapter's initial meeting of the fall season. John S. McKeighan of Lincoln Electric spoke on the application of welding in fixture construction and following his talk a sports film featured 1960 World Series highlights. Present at the meeting were the chapter's latest recipients of scholarship awards—two future engineers now enrolled at the University of Wisconsin. . . . PEORIA chapter recently joined the local group of ASSE in a program which emphasized the need for designing safety into tooling. . . . DAYTON chapter recently held a panel discussion on tool steels. Joining the group were 12 Dayton student members and 8 guests from the Acme School. . . . Early this fall 61 members and guests of CANTON chapter toured the U. S. Ceramic Tile Co.



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V-R MILLING CUTTERS

V-R Throw-Away Insert Milling Cutters bring the economies of "throw-aways" to your milling operations — provide lowest cost per edge for all roughing, semi-finishing and finishing cuts on light, medium and heavy duty cast iron, steel and nonferrous metals.

V-R "Rigidcut" Milling Cutters, with inserted blades, are available in two basic cone-type designs — fine pitch for high speed, fast feed milling and coarse pitch for light or medium feed and speed combinations.

V-R "Varicut" Milling Cutters, with inserted blades, give you 4-way interchangeability for plain milling, full side milling, half side milling and staggered tooth milling.

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Progress in Production

MASS-PRODUCED DRILLING MACHINE IS CONTROLLED BY TAPE

Can precision machine tools be mass produced? Yes, say many machine tool builders. There's no technical reason why any standard machine tool can't be produced in quantity, with consequent savings in manufacturing costs. The trouble with mass production of machine tools, say most builders, is that the market's not there. It's impossible to justify high-volume tooling economically unless production lots are substantial.

With its introduction of a mass-produced and low-cost tape-controlled drilling machine, Pratt & Whitney is betting $1.5 million on the willingness of customers to adopt tape control in their own plants.

There's no metalworking plant in the country that could not benefit from tape-controlled drilling, Pratt & Whitney officials feel. And during the next decade, companies that fail to equip their production lines with numerically controlled machines are going to fight a losing battle against the greater efficiency of companies that adopted tape control.

Tape-controlled drilling machine. All machine functions are controlled from cabinet to rear of operator. No jigs or other fixturing is required.

The Pratt & Whitney machine, called the Tape-O-Matic drill, costs less than $9000—a price that puts it within the buying range of even the smallest metalworking companies. Despite this low price, the machine is capable of giving the same type of performance as costlier, more elaborate drilling machines.

Circuitry is transistorized and modular construction is used throughout. The basic modules are printed wire circuit boards. Only four different types of boards are used, which means that the inventory of spare boards can be kept at a minimum. Use of transistors eliminates the need for mechanical switches and stepping relays up the reliability of the control system.

The control system has a floating zero which allows instantaneous positioning in all four quadrants and enables the machine operator to set up and zero the workpiece anywhere within the limits of the table's working surface.

Working surface of the machine table is 30 x 20 inches, with 20 x 15 inches table travel. Distance from the worktable surface to the spindle nose is from 4 to 24½ inches. Repeatability is ±0.0005 inch.

Standard punched control tapes are used. Tapes can be prepared on a tape punch typewriter by an operator who works from a process sheet furnished by a process planning engineer. An intermediate-sized computer can also be used to generate control tapes. A brief description—with simple numerical statements—of the locations in the workpiece to be drilled is fed into the computer. The computer then calculates the positioning operations to be performed by the tool. Output of the computer is a punched card. The

punched-card instructions are transferred to perforated tape for input to the drilling machine.

There's no reason, say Pratt & Whitney engineers, why the tape-controlled drill can't be used for production lots as small as one piece, with substantial savings over manually controlled drilling. And when the cost of tape preparation can be spread over several pieces, per-unit savings mount.

Practicing what it preaches, Pratt & Whitney used prototype models of its tape-controlled drilling machine to produce components for production models—an example of a machine reproducing itself automatically.

Experience with tape-controlled drilling has shown that savings result from three factors: (1) due to simplicity of setup and fast positioning, machine utilization is better; (2) fewer jigs and fixtures are required; and (3) scrap caused by operator error is virtually eliminated.

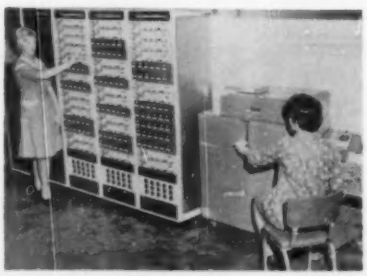
Pratt & Whitney is counting on the demonstrable savings that are possible through tape control to create a big market for its new machine.

And industry observers are pretty sure that Pratt & Whitney's bet on its low-cost tape-controlled drilling machine will pay off.

SYSTEM AUTOMATES FACTORY CONTROL, IMPROVES EFFICIENCY

Through sensing devices on each production tool, a new automatic system gathers, organizes and processes production data from every machine in a factory. It reports to a control room whether the tool is producing or not, totals productive time and downtime, and counts units produced and the uncompleted balance of the work order.

Information received on the control panels in the control room is collected and recorded on punched cards at the rate of 100 cards a minute. In addition, the equipment enters on the cards the machine operator's clock number, shift, the part number, operation number, piece rate, order number and other data. The punched cards are then fed into the plant's data-processing equipment to provide payroll information based on piecework, production progress reports and machine utilization reports.

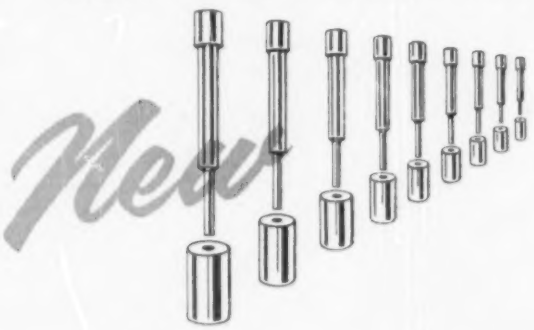


With a speed 180 times faster than that of clerical workers on the factory floor, this system gathers and records on punched cards the status of every production tool in a factory.

Tied in with this equipment, developed by Hancock Telecontrol Corp., is a communications system that enables a machine operator to summon assistance instantly if his machine requires adjustment or breaks down, or if he needs additional materials and tooling.

The system, called Readout-Telecontrol, consists of a switching cabinet that connects the sensor from any machine to any control panel; a monitor cabinet in which permanent records are made of as many as 40 operations; from one to nine control cabinets; and a EAM summary punch. Accuracy controls prevent readout if a double punch or no punch appears in any of the columns.

NEW! NEW! NEW! NEW! NEW!



NEW! NEW! NEW! NEW!

CARBIDE Standard PUNCHES and DIES

FROM STOCK . . . LOW COST . . . HIGH PERFORMANCE—All the red tape and high inquiry cost is eliminated when you order carbide punches and dies from Oberg's Standard Pricing Sheet. The standard punch or die you need is shipped right from stock . . . no delays! . . . and the price per unit is low!

Punches are stocked in standard point sizes from .060" to .374" together with corresponding die bushings . . . all made to the high quality and precision standards established by Oberg and recognized everywhere.

Need carbide standard punches and dies right now? Call or write Oberg! You'll like the service!

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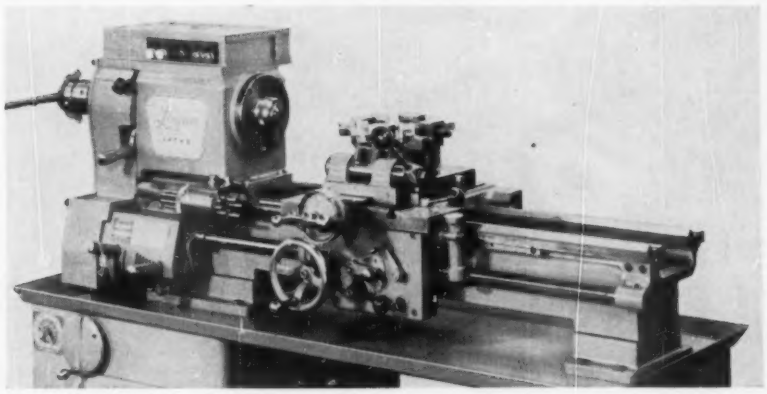
TOOLS of today

Chucking Machine Has Eight-Station Turret



Shown here is the Model 7500 eight-station-turret chucking machine. It can accommodate fixtures with diameters up to 14 inches. Maximum distance from the face of the turret to the spindle is 25½ inches. Using direct drive, the machine has a speed range from 170 to 2000 rpm. With the back gears engaged, the speed range is from 25 to 310 rpm. Carriage power feed is 0.0018 to 0.1000 inch per spindle revolution. Cross slide power feed is 0.0004 to 0.020 ipr. The machine uses ⅝-inch toolbits.

Logan Engineering Co., 4901 W. Lawrence, Chicago 30, Ill. **Circle 401**

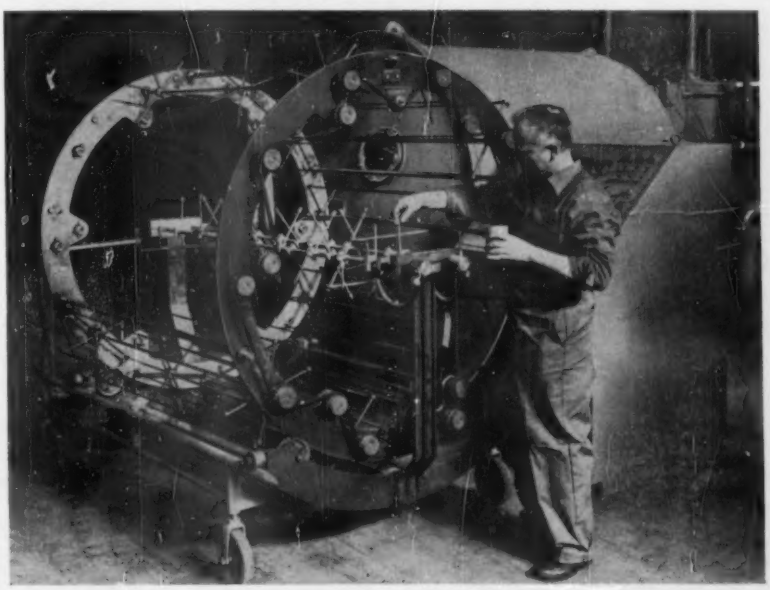
Vacuum Metallizing System Handles Greater Work Load

Three improvements have been made in this 72-inch vacuum metallizing system, Model 427-6. Its workholding capacity has been enlarged, its rate of metal evaporation increased and its gas-handling capability extended.

The planetary carriage can accommodate as many as ten 14-inch-diam reels at once. It gives 54 inches of usable length on every reel. It is designed to stand up under continuous operation.

Faster metal evaporation is achieved with a 30-kva power supply system. Its high input provides better throwing ability with the conventional filament arrangement or the same throwing ability with a larger number of filaments. This, in turn, allows coating more difficult parts in the same length of time.

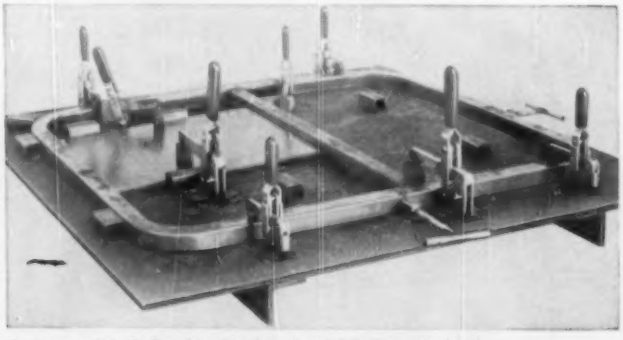
The pumping system uses a mechanical booster pump to back up two 16-inch oil diffusion pumps. Gas-handling capability is in this way extended into



YOU CAN HAVE PRE-PLANNED PRODUCTION

WITH DE-STA-CO TOGGLE CLAMPS

De-Sta-Co makes it easy to pre-plan production jigs and fixtures right on the drawing board! Detailed tracing templates, in full and half size, can be slipped under a drawing and spotted accurately—saves design time, speeds fabrication! Choose from over 140 models, there's a clamp for every job.



Steel welding fixture with 8 De-Sta-Co Model 267 Toggle Action Clamps holds parts securely during fabrication.

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the higher pressure ranges. Faster roughing and higher capacity for backing up the diffusion pumps result and pressure surges at the moment of firing are eliminated.

F. J. Stokes Corp., 5500 Tabor Rd., Philadelphia 20, Pa. **Circle 402**

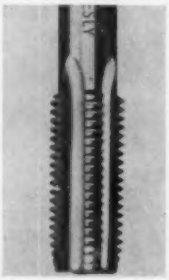
Transducer for Automatic Inspection

Typical uses for this displacement transducer include checking dimensions of workpieces machined in centerless grinding machines, gauging the thickness of billets and sheets, detecting wobble, measuring out-of roundness and positioning machine tools. It has a linear variable differential transformer with a range displacement of ±0.500 inch. It has a three-point mounting flange and a receptacle and plug for quick electrical connections.

Automatic Timing & Controls, Inc., King of Prussia, Pa. **Circle 403**

Top Thread Form Minimizes Chipping

Because the "V" at the bottom of the thread form has been eliminated, this tap has high strength. The thread form clears any hole drilled for 85 percent of thread or less. This includes 95 percent of the tapping applications involving standard stocked tools. The chamfer of the tap provides immediate cutting, thereby minimizing chipping and lengthening tool life. The thread form is especially suitable for hand tool tapping.



Besly-Welles Corp., South Beloit, Ill. **Circle 404**

Adjustable Boring Bars Use Throwaway Inserts

Diameter adjustment in 0.001-inch increments is combined with the economies of carbide throwaway inserts in a line of boring bars. Light, medium or heavy cuts are possible because of chip control provided by the built-in, adjustable chipbreaker. These bars are suitable for use on automatic or hand

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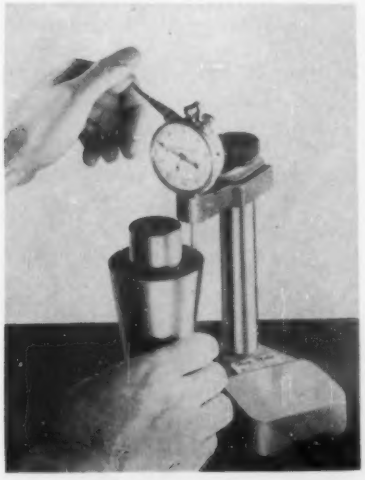
screw machines, boring mills, turret lathes and multiple spindle bar machines. They are available in three styles—the first with interchangeable heads for finish boring diameters from ½ to 1½ inches, the second for shallow boring diameters from 1.50 to 2.20 inches, and the third for deep hole boring diameters from 1.60 to 2.60 inches. Four nonadjustable styles with throwaway inserts are also available for boring diameters from 1¾ to 3 inches.

Vascoloy-Ramet Corp., Waukegan, Ill. **Circle 405**

Instrument Checks Height, Size

Shown here is the Hite-Mike in one of three models. It consists of a 1-inch-thick base, a 6-inch-high column, and a 1-inch-thick yoke. The column is made up of five 1-inch-high tubular gage blocks. This model—Number 5836—has a 1-inch dial indicator mounted in the yoke. The indicator has graduations in 0.001-inch increments and readings from zero to 100. Model 5837 provides readings in 0.0001-inch increments on a ½-inch range dial indicator. The dial is graduated from zero to 10 and its two count hands show 0.010 and 0.100 inch of movement. The third model—number 5835—has a 1-inch micrometer



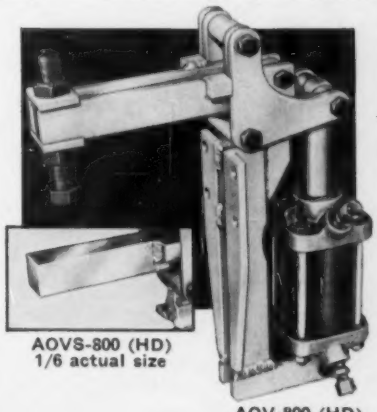
head and can be used for setting heights from zero to 5 inches. If a surface plate is used as the zero point, it can set heights from zero to 6 inches. The micrometer head has slant-line graduations and reads in 0.001 inch.

Brown & Sharpe Mfg. Co., Providence 1, R. I. **Circle 406**

Roll Turning Lathes Lessen Setup Time

Farrel-Betts three-way bed, general purpose and roll turning lathes are available in models with from 32 to 92 inches of swing over the bedway. They assure rigid support of the work in two manners. First, the cutting force falls between the front and middle ways. Second, it is not necessary to extend the tailstock quill to reach across the carriage bridge in facing the end of the workpiece. The carriage passes completely by the tailstock. The carriage is designed so that numerical and/or tracer control can be applied. Its feed has a sectional threaded rack with a pair of adjustable screws for backlash control. No leadscrews, rods or shifter mechanisms are needed. The headstock spindle is driven by a d-c, adjustable speed motor with a 4:1 speed range. Large chip disposal areas are provided in the bed.

Farrel-Birmingham Co., Inc., 565 Blossom, Rochester, N. Y. **Circle 407**



AOVS-800 (HD)
1/6 actual size

AOV-800 (HD)
1/6 actual size

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The all new Heavy Duty AOV Series, features three basic sizes of 200, 400 and 800 lbs. clamping force respectively. Each size may be specified with either solid (inset) or channel toggle bars and spindle assembly (top).

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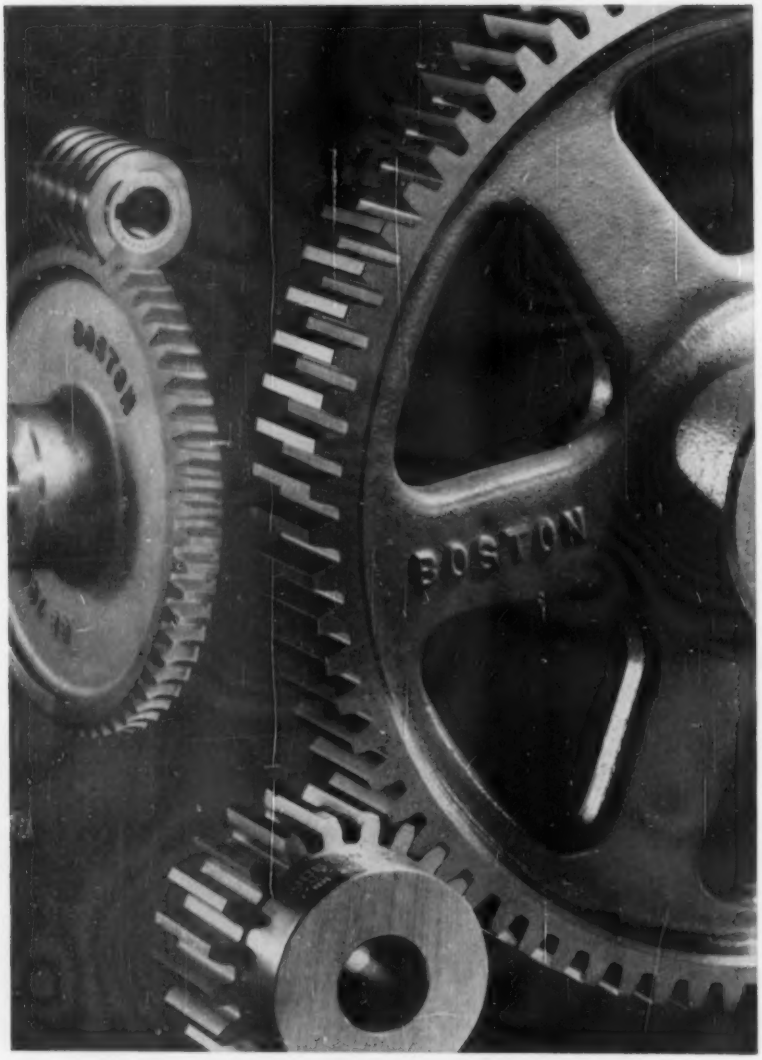

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Tool Bores, Grooves, Faces in One Setup

With one setup, this tool bores, faces and grooves. It can be used also for counterboring, back counterboring, OD turning, chamfering and both ID and OD grooving. As a boring head, the E-Z Set tool has a graduated dial around the entire body, which provides direct reading in 0.0001 inch. The tool does not need to be locked during finish-boring cuts. The tool is available in three sizes with feeds from 0.0025 to 0.005 ipr and with returns from 0.100 to 0.200 ipr. Feed and traverse are accomplished without stopping or reversing the spindle.

Maxwell Industries, Inc., 493 E. Fifth St., Ashtabula, Ohio. **Circle 408**

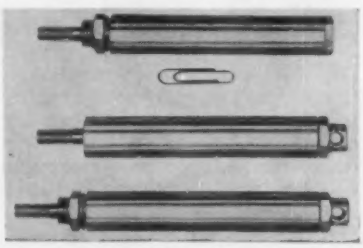
Miniature Tools for Close Tolerance Reaming

All materials including steel can be reamed with these solid carbide tools, which are of four-flute, straight-flute design with diameter tolerances of +0.0001 to +0.0003 inch. Series 9164 is made up of eight tools with diameters from $\frac{1}{32}$ to $\frac{1}{8}$ inch. Series 9158 covers eight decimal sizes from 0.0151 to 0.115 inch. These reamers can be used on abrasive plastics, synthetics, fibers, exotic alloys and steel with hardness up to Rc 56.

Atrax Co., Newington, Conn. **Circle 409**

Air-Hydraulic Cylinder for Jigs, Fixtures

This screw-together $\frac{9}{16}$-inch-bore cylinder handles air pressures to 250 psi and hydraulic pressures to 2000 psi. It is available in double-acting models with strokes from 1 to 6 inches and in single-acting models with 1, 2 or 3-inch strokes. The piston rod extends $\frac{3}{4}$ inch and is threaded $\frac{1}{4}$-28 x $\frac{1}{2}$ inch. Power factor of the cylinder is 0.24 on the push stroke and 0.20 on the pull. Stud,



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clevis and universal mounting are possible.

Clippard Instrument Laboratory, Inc., 7390 Colerain Rd., Cincinnati 39, Ohio. **Circle 410**

Hole Saw Has HSS Cutting Edge

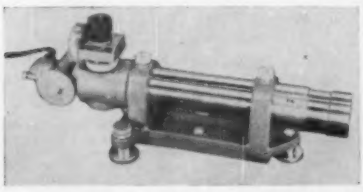
Holes in any machinable material up to 1⅛ inch thick can be cut with the Weld-Edge hole saw. It is well-suited for use on portable tools, drill presses, lathes, boring mills and milling machines. Its wear-resistant, high-speed steel cutting edge is permanently bonded to an alloy steel body for maximum strength and resiliency.

Knock-out slots make removing the cores fast and easy. Follow-through design permits sawing deep holes in stacked or layered materials where cores can be removed. The saw is available in hole sizes from 3/16 to 6 inches and in mandrel sizes for light to heavy cutting.

Simonds Saw and Steel Co., Fitchburg, Mass. **Circle 411**

Autocollimator Measures Two Planes

With this instrument—the Model TA-51 Microptic autocollimator—horizontal and vertical planes can be read simultaneously to 0.1 sec over a range of 10 min of arc. The illuminator and micrometer units are interchangeable to allow both straight and right angle viewing. The objective lens can view objects at distances of 100 ft. Model TA-50 has the same features except that it views two planes individually without rotating its tube. The instruments are well-suited for testing surface plates, machine tools, gear cutting de-



vices, circular tables, dividing heads, missile guidance units and test equipment.

Engis Equipment Co., 431 S. Dearborn St., Chicago 5, Ill. **Circle 412**

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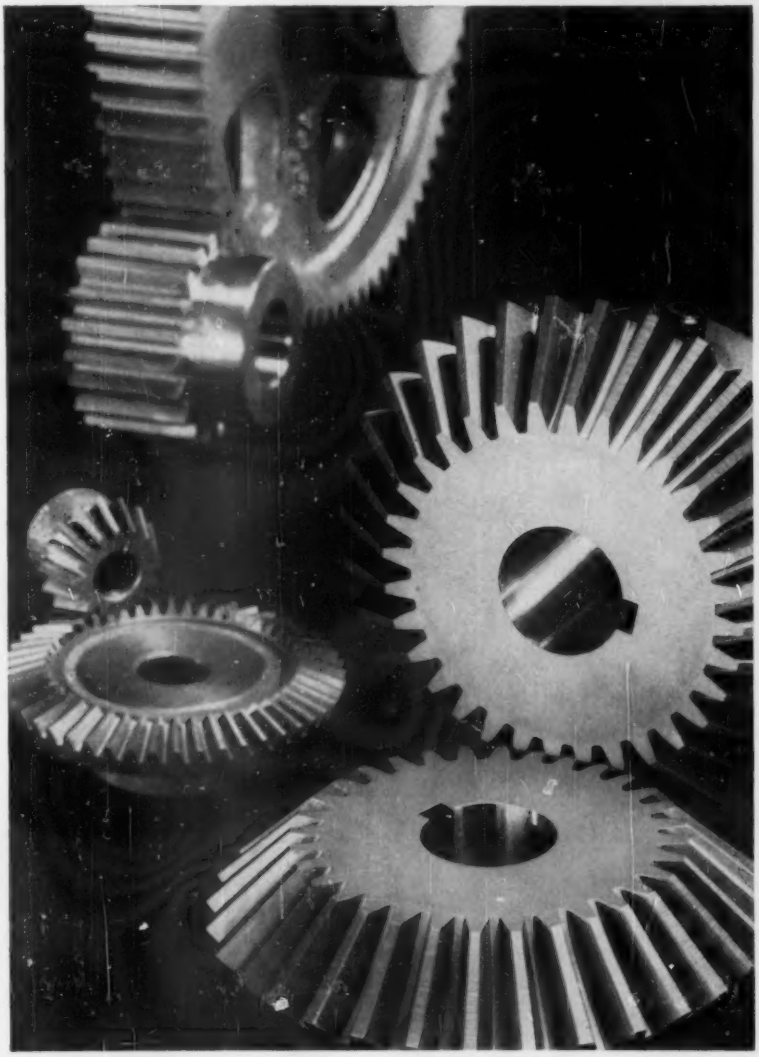

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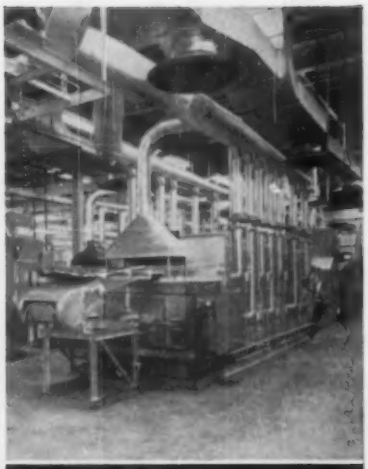

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Gage Measures Groove Width

Model B-1400 gage can be used for checking the location, depth and width of grooves. To check width, the gage is positioned on the part so that the foot rests on one surface. The operator then slides a pushbutton to the opposite side of the groove. The width is the distance traveled by the gaging rod plus the thickness of the foot. The gage has a 0.187-inch gaging rod, a 0.0005-inch 0-25-0 dial indicator, one footed rod and a straight rod.

Boice Gages, Inc., Hyde Park, N. Y. **Circle 413**

USE READER SERVICE CARD ON PAGE 137 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Electronic System Gages Hard-to-Check Points

As many as 24 probes can be read out either individually or in automatic sequence, with the Model CS-24 electronic gaging console. Each gage location and the variation from nominal part dimension is shown in lighted, 1-inch-high numbers in the readout windows. The machine also prints a permanent record, if desired, on tape, cards or stickers. The system uses

sensitive transducers in place of dial indicators or air probes. The small size of the probes—$\frac{3}{8}$-inch-diam x $2\frac{15}{32}$—and their flexible connecting wires allow checking hard-to-reach points. The console also reads the variation in nominal part thickness between any two opposed probes. Accuracy is to the nearest 0.0001 inch.

Winslow Manufacturing Co., 1751 E. 23rd St., Cleveland, Ohio. **Circle 414**

Gaertner Toolmakers' Microscope used to measure typical piece part. Co-ordinate range 4" x 2".

Precise measurement to 0.0001" and 1 min. of arc

Gaertner Toolmakers' Microscope

Here is a reliable, easy-to-use microscope for precise measurement of piece parts, tools, dies, thread gages, templates, jigs, fixtures, etc. Ideally suited for making a wide variety of precision measurements and is especially valuable in reducing rejects in production work.

With the Gaertner Toolmakers' Microscope you make direct, non-destructive measurements — no contact, no distortion, images are sharp and clear. It is a basic measuring instrument for inspection depts., gage labs, tool and die and model shops, industrial and research labs.

The Gaertner Toolmakers' Microscope has been proven in use by U. S. Government Gage Laboratories, and by prime contractors and their subcontractors. With all parties using the same measuring instrument, inspection procedures are co-ordinated and disagreements and rejects minimized.

Features that help you get
HIGH SETTING AND REPEATING ACCURACY

- Low, compact built-in rotary stage reads to 1 minute of arc throughout 360° range.
- Minimum overhang of stages.
- Full 2" precision-lapped lead screws with correction device.
- Straightforward, direct, uncomplicated optical system.

Features that assure you of
EASY, CONVENIENT OPERATION

- Independently rotatable cross hairs in protractor ocular speed up measurements, simplify measuring procedure.
- Convenient location of ocular eyepieces for ease of reading.
- Built-in transformer and plugs for all illuminators.

Modifications and accessories to
MEET YOUR EXACT REQUIREMENTS

- Thread and radius templates, camera and spotting attachments, fine motion focus, variable magnification available.
- If you have a special measuring problem, our staff of representatives will be happy to consult with you. The service and engineering facilities of the manufacturer are always immediately available to help you.

Write for Bulletin 147-56
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ELIMINATE THOSE PROBLEMS—reduce maintenance and down-time—step-up production and solve the problem of costly repairs and replacement of air tools.

Compact package unit solves all three problems simultaneously.

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AIR EQUIPMENT and tools give top performance when the "working" air stream is
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LUBRICATOR

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QUICK DISCONNECTS

The fast, easy operating PSC Disconnects permit quick, economical making and changing set-ups. **Less down-time—more production time.**

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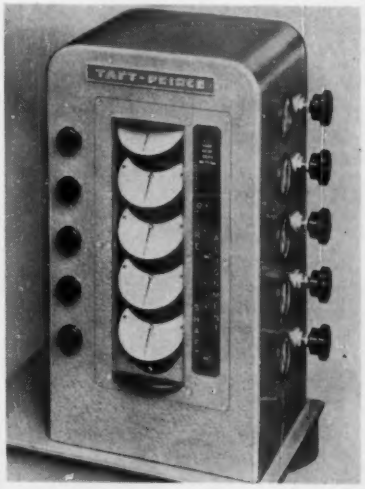
Unit Programs Computers for NC

Computer language programming for every Mark Century numerical contouring control will soon be available to any user of the APT programming system. A complete library of computer routines known as the Post Processor, the system will make it possible for any APT-oriented computer to translate written English language instructions into the punched paper tape programs used to direct automatic metalworking machine tools. The library contains routines for solid-state numerical contouring controls from the two-motion to five-motion types.

General Electric Co., Schenectady 5, N. Y. **Circle 415**

Dial Arrangement Cuts Gage Cabinet Size

Readings from five different points are shown on dials in this 10¼ x 18½ x 9-inch cabinet. Compactness of the dials is achieved by mounting them in vertical rows at a 45-deg angle to the



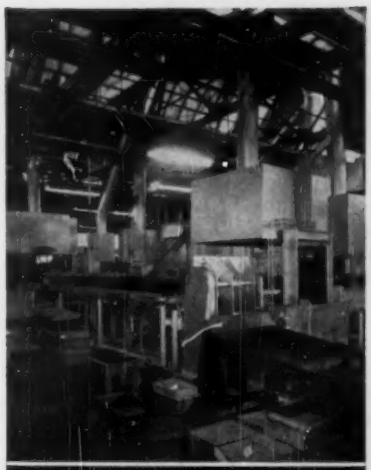
cabinet panel. In addition to reducing space requirements, this arrangement permits full visibility of the entire sweep of the indicator and allows checking all readings at a glance.

Taft-Pierce Manufacturing Co., Woonsocket, R. I. **Circle 416**

Unit Increases Spindle Speeds

Drill Speeder Model 125 increases spindle speeds at a ratio of 6.25:1 and has a capacity from 80 to ⅛ inch. It can be used in manual, semiautomatic or fully automatic operations on all types of drilling machines. Spindle speeds from 1200 to 3200 rpm will produce drilling speeds up to 20,000 rpm.

Tapmatic Corp. **Circle 417**



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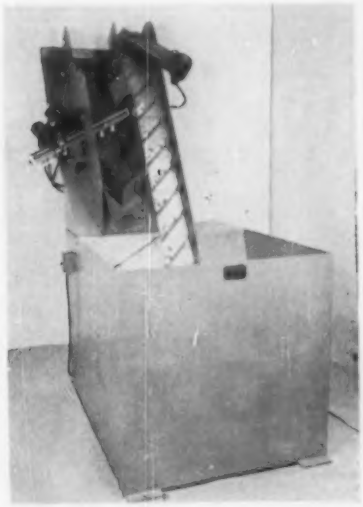
Hopper Orients, Feeds and Counts Parts

As many as 1000 pieces a minute can be oriented, fed and counted with this elevator hopper and its roller type track. Pieces of various sizes, shapes and materials can be handled without changing parts. Change-over is made in less than 5 min by adjusting screws. The unit consists of a box type storage hopper with a 10-cu ft capacity and an inclined, cleated conveyor. The conveyor picks up and partially orients the workpieces and then discharges them at a higher



elevation onto the orienting rollers. Here the workpieces are completely oriented and the excess rejected into the hopper for recirculation. The track can be equipped to release more than one item at a time.

Count-O-Matic, Inc., 40-24½ 22nd St., L. I. 1, N. Y. **Circle 418**

Indexing Chassis Has Vertical Table

Available with a 20, 30 or 40-inch turret, this indexing machine chassis is designed to facilitate tooling of automatic machine applications. It has a crossover indexing cam that provides a cycloidal displacement cam path. Main index camshaft extensions allow mounting operational cams to actuate tooling mounting timing cams for electrical initiation of tooling sequences, and for actuating auxiliary camshafts for additional tool motions. Tooling can be mounted on a stationary center plate inside the turret periphery or on mounting brackets located around the turret face. The chassis has an electric clutch brake, a limit switch

and a timing cam for cycle control and a tooling interlock. A positive locking device is automatically engaged during the turret dwell portion of the work cycle.

Swanson-Erie Corp., 814 E. Eighth St., Erie, Pa. **Circle 419**

Miniature Cutting Tools Handle Many Jobs

Ten types of miniature high-speed steel end mills include single and double-end, two-flute ball end styles, single and double-end two-flute styles, and single-end, four-flute styles in various cupped-end or center-cutting plunge mills. All have 3/16-inch shanks, and range from 1/32 to 3/16 inch. They are used for milling straight slots and grooves or slots in dies, molds, tools, electrotypes, engravings, plastics and plastic-metal laminates. They are also suitable for general purpose milling. The high-speed steel combination drills and countersinks are offered in three sizes with 0.020, 0.025 and 1/32-inch drill diameters. All have a 1/8-inch body diameter and are the double-end, 60-percent included angle style.

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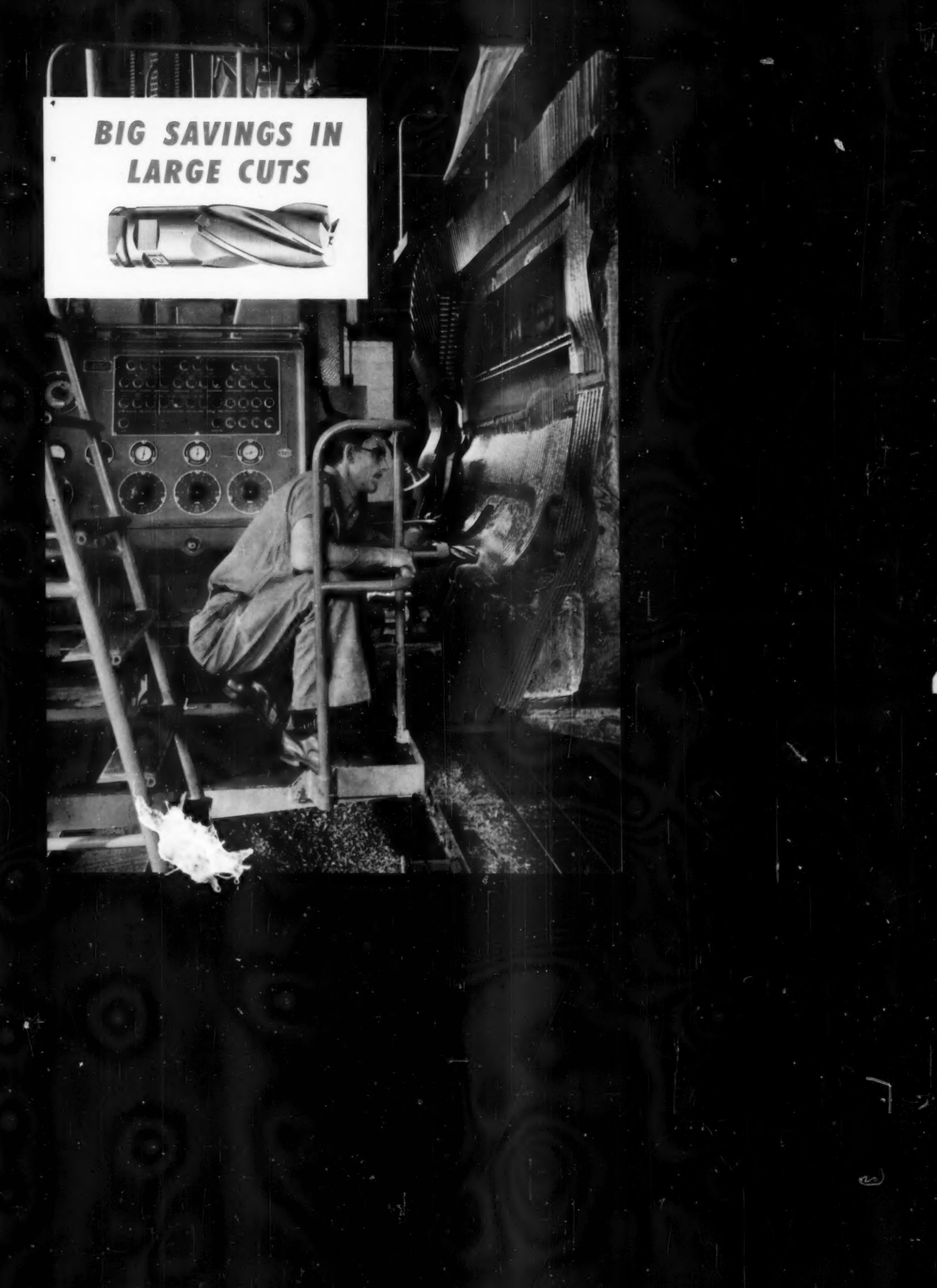
Quality Tool Works, 322 S. Elmwood Ave., Waukegan, Ill. **Circle 420**

Vacuum Furnace Has Extended Heat Range

This extended-range vacuum heat-treating furnace is capable of operating at temperatures of 2500 C. The cold-wall resistance-heated unit, Model 435-585 can be used for sintering tantalum anodes; for advanced research and development; for production heat-treating parts for nuclear systems; and for vacuum brazing. Other applications include bright annealing; processing of aerospace components such as rocket engine nozzles and manifold assemblies; experimental work on honeycomb structures made of refractory metals; and heat-treating in inert atmospheres. The furnace has a tantalum hot zone 7 inches in diameter and 14 inches high. It uses no refractory insulation. Conversion to work at 1600 or 1700 C is done by replacing the tantalum hot zone.

F. J. Stokes Corp., 5500 Tabor Rd., Philadelphia 20, Pa. **Circle 421**

Use Reader Service Card, CIRCLE 71

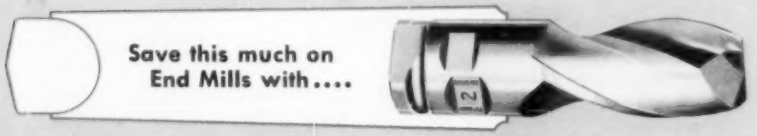

BIG SAVINGS IN
LARGE CUTS

CUT YOUR COSTS OVER 25% ON END MILLS 1½" DIAMETER AND LARGER WITH

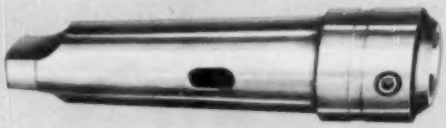
The Putnam Postiv-Lok design for large end mills eliminates the need for and expense of long tapered shanks. Instead, the Postiv-Lok concept of end mill tooling puts the heavy shank on a holder that quickly pays for itself through savings realized in the purchase of Postiv-Lok end mills.

Also, the use of Postiv-Lok end mills and holders eliminates the costly breakage that is possible with welded shank end mills. Postiv-Lok end mills are milled from solid steel—there are no welds that might break and separate the shank from the fluted portion. Thus, Postiv-Lok eliminates a cause of costly shut-downs and replacements.

Another cost saving is realized with Postiv-Lok during tooling change-over. Being much lighter, Postiv-Lok end mills are easier to handle than large tapered shank end mills—easier to insert and remove. And, when the next operation requires a different style or size of end mill, or even drilling and reaming, Postiv-Lok adapters permit quick change-over from one tool to another without changing the holder in the spindle.

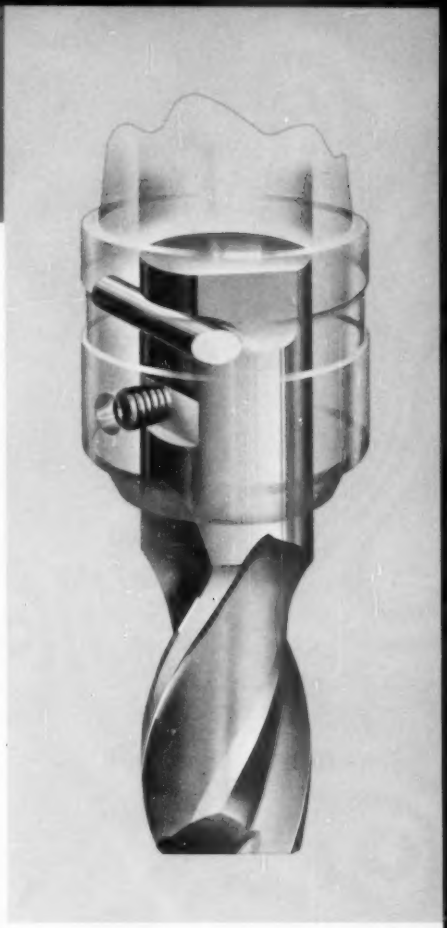


PUTNAM POSTIV-LOK HOLDER



PUTNAM PRECISION TOOLS

PUTNAM POSTIV-LOK



Postiv-Lok is a proven locking mechanism for large end mills. It has saved time and costs for countless users throughout the country. Try it on your most rugged milling application. Postiv-Lok is available from stock on end mills ranging from 1½″ to 3″ in diameter. Also, it can be furnished in special sizes and designs to your specifications.

Here is how Postiv-Lok assures positive locking of end mills in the holder (see phantom drawing for lock construction). Simply insert the end mill in the holder so the top flat is positioned to pass the locking pin; give the end mill a quarter turn to the right and it is securely locked in the holder. Tightening of holder set screw prevents end mill backlash. The end mill cannot vibrate loose or pull out of the holder. In fact, the locking action is aided by the torque of the end mill in operation.

When put to work on big jobs, the fast, free-cutting action of Postiv-Lok end mills really save time and costs. Also, their exceptional durability assures long life even when operated at high speeds and heavy feeds. Try them on your toughest jobs—they will get them done faster and at lower cost.

CUT FASTER — LAST LONGER

Over 1800 Standard Types & Sizes of Putnam End Mills

Now you can order standard end mills ranging in diameter from 1/32" to 6" and get off-the-shelf delivery. In the Putnam line of over 1800 standard types and sizes, are many end mills that are considered as "specials" by other manufacturers.

Regardless of your requirements, there probably is a Putnam standard end mill that will exactly meet your needs. Thus, you can obtain quicker delivery, plus all the superior Putnam cutting qualities, and at lower costs than "specials".

You will save time, money and space by using the services of your local Putnam Distributor

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- Using his services assures savings in your stockroom space requirements.
- His stocking of products means you have less money tied up in inventory.

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Air Chuck Assures Concentricity Accuracy

Because it has a "doughnut" piston design, the '09 air-operated chuck permits bar stock to be passed completely through it. The chuck uses double-angle collets and provides 1/32-inch collapse with uniform gripping power throughout the length of the collet. The outer shank of the chuck does not rotate, thereby eliminating the need for rotary air connections. The chuck is made with 7½, 8¾ and 10-inch diameters and will hold work ranging in diameter size from 0.468 to 2.125 inches.

Erickson Tool Co., 34350 Solon Rd., Solon, Ohio. **Circle 422**

USE READER SERVICE CARD ON PAGE 137 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Drill Handles Tough Jobs

Designed for builders, electricians, mechanics and maintenance men, the Model 372 ½-inch drill has a 3.6-amp motor and all ball-bearing construction.

It weighs 5 lb and has a capacity of ½ inch for steel and 1 inch for wood. A speed of 750 rpm is maintained through three-stage gear drive. The drill is constructed so that it can reach hard-to-reach places. It has a three-jaw geared key chuck for positive nonslip gripping power that eliminates bit runout.

Rockwell Mfg. Co., Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa. **Circle 423**

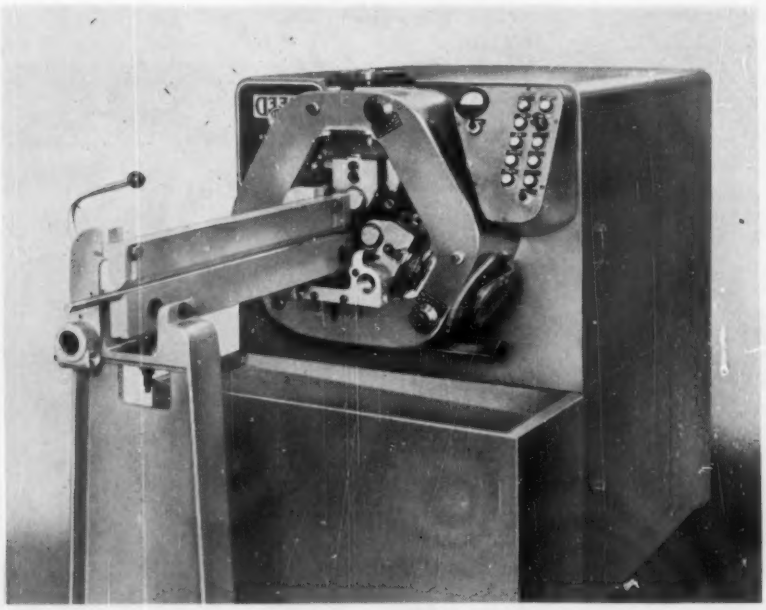
Machine Cuts Holes, Removes Broken Tools

This metal disintegrating machine is used for removing broken taps, reamers and drills and for cutting shaped holes in any metal that will conduct electricity. The size and shape of the hole—determined by the size and shape of electrode used—can range in diameter from 0.015 to 1 inch without distorting or annealing the workpiece. Model C-2 has a radial arm consisting of two separate sections which extend 25 inches or

buckle together for work close to the column. The machine's head assembly is adjustable for vertical or angular operation. Its quill has an over-all length of 15½ inches and a travel feed of 9 inches. The vertical shaft has a 3-inch-OD and is 60 inches long.

Jiffy Tool Supply Co., Inc., 1503 E. Seven Mile Rd., Royal Oak, Mich. **Circle 425**

Machine for Through-Feed Thread, Form Rolling



In its simplified form, the Model A25 machine has adjustable die holders that remain in the rolling position for continuous through-feed threading of long or short work. Set at either parallel or skewed axis, the three dies provide self-centering of the work, eliminating the need for separate positioning and supporting accessories. The triangular stress system confines radial rolling loads in tension and provides capacity for rolling loads up to 30,000 lb. Threads and forms from ½ to 2½ inches in diameter are rolled in aluminum, brass, stainless and various alloy and heat-treated steels. The machine has a 15-hp motor. Eight die speeds from 105 to 695 rpm provide production rates ranging from 6 to 300 ipr.

Reed Rolled Thread Die Co., 791 Main St., Holden, Mass. **Circle 424**

Dial Indicator Has 2500:1 Magnification

Accuracy over the full AGD range of 0.010 inch is provided by the Micro-Sure, MSE ½K dial indicator. This indicator has a 3¼-inch-diam dial, with a 2500:1 magnification and 0.000050-inch graduations. Calibration accuracy is within 0.000050 inch and repetitive accuracy is within 0.000005 inch. The device is designed to allow the indicator movement to follow plunger motion, instead of being driven by it. This provides positive protection against shock in either direction. Other models have ranges of 0.010, 0.020 and 0.025

Use Reader Service Card, CIRCLE 74

inch with minimum graduations of 0.000050 and 0.0001 inch.

Federal Products Corp., Providence 1, R. I. **Circle 426**

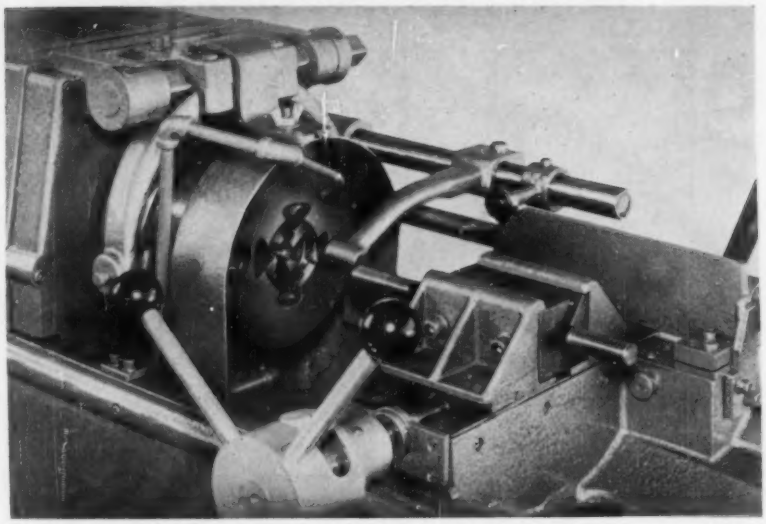
Unit Smooths Cylinder Stroke Variations

The Series S hydraulic checking cylinder smooths out stroke speed variations and provides dial set speed

control at any desired stroke speed from 3 to 300 ipm. Maximum checking capacity is 1000 lb on the out stroke, with free return. Features of the unit include a chrome-plated steel piston rod with wrench flats, built-in rod wipers with automatic compensation for wear and a refillable oil reservoir with a built-in "low" signal.

Modernair Corp., 400 Preda St., San Leandro, Calif. **Circle 427**

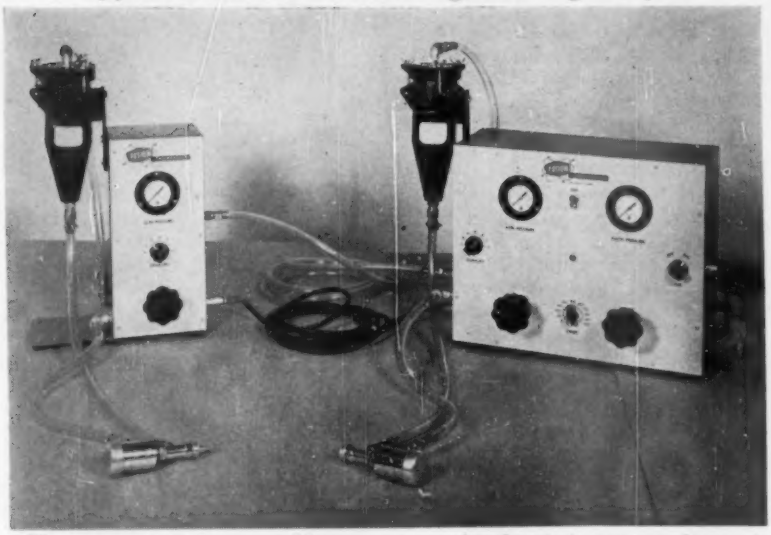
Portable Machine Threads Pipe, Bolt



This rotary head pipe and bolt threading machine threads ⅜-inch material at 130 rpm. It can thread ¼ to 1½-inch bolt or ⅜ to 1¼-inch pipe. Dies can be changed in 2 min by releasing a compression ring. Additional features include a semiautomatic trip and reset head, full ball-bearing construction and full range vising. It has a knocker type chuck. An adjustable automatic thread length stop ceases threading and opens the vise at preset thread lengths.

Obear & Sons Sales, Inc., 940 W. Florence Ave., Inglewood 1, Calif. **Circle 428**

Applicator Doubles Soldering, Brazing Output



This twin automatic paste solder applicator is capable of making two deposits of paste solders or paste brazing alloys at the same time. It automatically applies solder or braze alloy and flux to the parts to be soldered or brazed while the parts are on the soldering line. The twin applicator uses the electrical circuit and one air circuit in both units. Each unit has an individual applicator gun and a paste storage tank. The units can be individually controlled for amount of deposit and can cycle independently.

Fusion Engineering, 17921 Roseland Ave., Cleveland 12, Ohio. **Circle 429**

Coupling Has Self-Contained Air Cylinders

Because the Idler air coupling has self-contained air cylinders, the center of the chuck is left open for through-feeding of bar stock or for gaging equipment. The coupling is periphery

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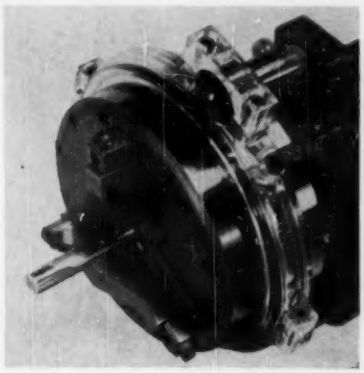
controlled and air actuation is accomplished by inserting air through the cylinder wall. In operation, after the



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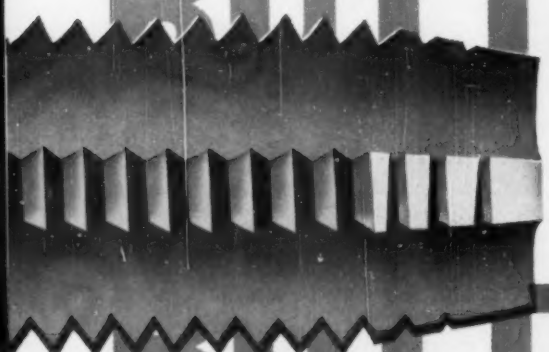

Like all tools in the complete Butterfield line, Butterfield taps are noted for precision performance, long life, and high value as production tools — not only when used individually but with other taps or cutting tools. Get these production benefits . . . through prompt deliveries and trained technical service in your machining operations . . . Call your Butterfield Distributor. Warehouses in Chicago, Detroit, Fort Worth, Los Angeles, New York and San Francisco.

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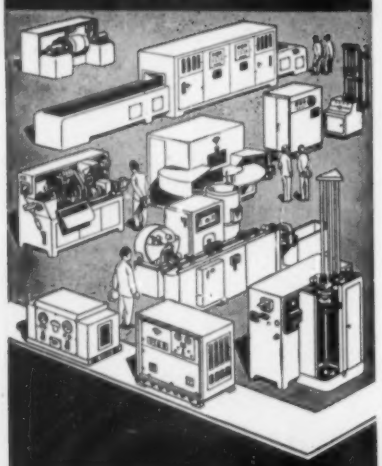

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TOOLS of today

work spindle is stopped, the air is turned on and enters the air supply ring under the O-rings blowing them out against the faces of the recessed cylinder. After air reaches the diametrically opposite sides, it enters the circular space under the air supply ring and from there enters the piston area through holes in the cylinder wall. When the chuck is loaded and the air turned off, it escapes through the same passages. The O-rings relax and rest clear in oversize circular grooves.

N. A. Woodworth Co., 1300 E. Nine Mile Rd., Detroit, Mich. **Circle 430**

Tumbling Media Deburrs, Finishes Surfaces

Steel wool fibers are formed into shapes with a resin binder to make this handling media. These shapes, used dry, produce either a satin or matte surface finish with luster and high color.

They can remove 0.002-inch burrs from parts such as those made by screw machines. Weight of the material is 55 lb/cu ft.

Antro Abrasives, Inc., 177 E. 80th St., New York 21, N. Y. **Circle 431**

Unit Controls Carbon in Furnace Atmospheres

Carbon potentials of furnace atmospheres can be automatically controlled with the Infrared Carbotrol. This instrument is a dual-range unit with automatic range switching. The two ranges are zero to 0.2 percent CO_2 and zero to 1.0 percent CO_2. Calibrating gases are located within the control panel. The unit can be used for atmosphere control for carburizing, neutral hardening and carbon restoration and can be used with any dew point gas.

Lindberg Engineering Co., 2450 W. Hubbard St., Chicago, Ill. **Circle 432**

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WHAT EVER HAPPENED TO THE OLD WAY OF FINISHING TOOLS ?

The old way, requiring the time and skill of a tool-finishing expert, has become obsolete. The new, more accurate way to precision finishing is with the **GRIND-R-LAP,** the machine with the oscillating-magnetic head. The compact, bench model **GRIND-R-LAP** makes anyone a tool finishing expert. And the **GRIND-R-LAP** price makes it practical for every shop. SEND FOR FREE, ILLUSTRATED BROCHURE — it tells the whole story.

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GRIND-R-LAP DIVISION
Dept. TME 9200 Bolsa Ave. Santa Ana, California

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NEW LITERATURE

manufacturing data you can use

IN ADDITION TO GENERAL information on mechanical differentials and design criteria, a brochure presents a group of stock and pre-engineered differential drawings. Dynamic Gear Co., Inc. **(Circle 501)** . . . "Lord Vibration/Shock/Noise Control" is the title of a brochure describing methods and devices for controlling these problems. Lord Mfg. Co. **(Circle 502)** . . . Face and cylindrical cams, two and three dimensional cams, aircraft cams, master cams, hydraulic pump cams, and cams for wrapping and packaging are illustrated in a bulletin. Eonic Inc. **(Circle 503)**

Automation, Mechanization

"Advanced Trends in Electric Gaging" explains the function of an electric indicator and control units and describes typical applications of electric gaging to reduce cost of parts fabrication and inspection. Hamilton Watch Co. **(Circle 504)** . . . A 14-page brochure explains how to analyze machinery investment and how to decide when and what to automate. Designers for Industry, Inc. **(Circle 505)**

Boring, Drilling, Tapping

An automatic-cycle drilling and tapping machine has building-block construction to assure maximum economy in converting the machine to different jobs. Cleereman Machine Tool Corp. **(Circle 506)** . . . A line of continuous-feed heads for boring, facing, turning, backfacing, recessing, threading, grooving, grinding and other work includes 12 models covering a range of work from 7/16 to 96 inches in diameter. Giddings & Lewis Machine Tool Co. **(Circle 507)** . . . A brochure on heads for drilling, reaming, tapping and boring suggests product application, explains the relation of heads to automation, and includes drawings and tables required in production planning. Zagar, Inc. **(Circle 508)**

Cutting Tools

How to select the best carbide turning tool design for specific applications is discussed in a booklet. Wesson Corp. **(Circle 509)** . . . Combined drills and countersinks, keyseat cutters, arbor type keyseat cutters, cutter reamers, lathe mandrels and machine countersinks are covered in a catalog. Also illustrated are special tools such as long drills, tapered shank drills, drill and spotfacers, bell type center drills, keyseat and T-slot cutters, hub saws, screw slotters and angle cutters. Keo Cutters, Inc. **(Circle 510)** . . . Sizes, specifications and instructions for a complete line of carbide drills, end mills, boring bars, counterbores and countersinks are given in a catalog. Mill-All Co. **(Circle 511)** . . . Small drills in wire sizes from No. 40 to No. 80, miniature end mills, stub routers, hole grinding burrs, midget burrs and microreamers are a few of the tools for electronics circuit board and instrumentation applications listed in a brochure. Atrax Co. **(Circle 512)** . . . Thirty brochures, booklets, catalogs and article reprints are described in a list of available cutting tool literature. Brown & Sharpe Mfg. Co. **(Circle 513)** . . . Broach kits save time and money when setting up a machine tool for cutting keyways in gears, milling cutters, collars and couplings. duMont Corp. **(Circle 514)**

Electric Motors, Controls, Drives

Power for computers, industrial control and automation systems, and telemetering and missile guidance systems can be furnished by power sets in a line described in an eight-page catalog. Electric Specialty Co. **(Circle 515)**

To receive the manufacturing data you want, just circle the appropriate number on the Readers Service Card on page 137.

If you want information on items not listed here this month, write to New Products Editor, THE TOOL AND MANUFACTURING ENGINEER, 10700 Puritan Ave., Detroit 38, Mich.

Fluid Power

A line of 5000-psi piston pumps and motors is described in a booklet. The units have instant response to the controlling signal, and reversible flow. They operate at 1200 rpm and higher. Vickers, Inc. **(Circle 516)** . . . Full details of a line of valves and cylinders are given in "Unfailing Performance for Millions of Cycles." Rivett Lathe & Grinder, Inc. **(Circle 517)** . . . A line of floating piston cylindrical accumulators includes styles with working pressures up to 20,000 psi. All accumulators in the catalog are designed for operating temperatures from —40 to 180 F. Superior Pipe Specialties Co. **(Circle 518)** . . . A new lock value permits prolonged holding of a cylinder by nullifying leakage and provides smooth actuation of the cylinder with negligible power loss. The valve is designed for use with hydraulic oils and other noncorrosive fluids at pressures up to 3000 psi and for operation with ¼-inch, four-way valves. Sarasota Precision Products, Inc. **(Circle 519)** . . . One feature of a line of square head cylinders for 1½ to 14-inch bore sizes is that the cylinder can be converted for low pressure hydraulic service. Tomkins-Johnson Co. **(Circle 520)** . . . A bulletin explains and illustrates how electrohydraulic servo controlled one and two-way, variable delivery pumps—in capacities up to 108 gpm and 3000 psi —function. Other pages describe amplifiers, preamplifiers, preset units, manual units transformers, transducers, control panels, consoles, cylinders and hydraulic motors. Oilgear Co. **(Circle 521)**

Heat-Treating

Fluidized heating beds reduce heating time by as much as 85 percent for annealing, normalizing, solutionizing, aging, hardening, quenching and isothermal transforming. General Electric Co. **(Circle 522)**

Inspection, Measurement

How to designate characteristics of surface irregularities, how to measure specified surface characteristics and how to use an instrument for measuring

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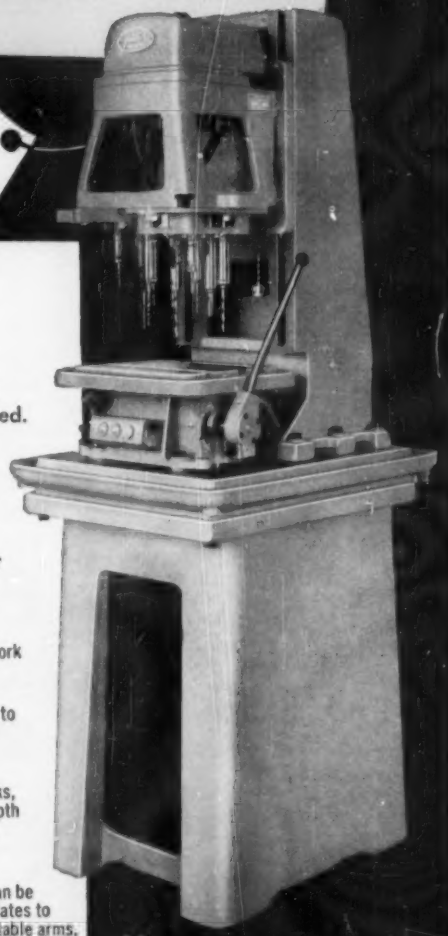
No. 65 for Drilling • No. 66 for Drilling & Tapping

LOWEST PRICED AMERICAN MADE UNIVERSAL DRILLING & TAPPING MACHINE

Basic Drilling Machine Price Starts at Only $1795.00 (Less Spindle Assemblies)



Floor Type, Self-Contained Universal Joint Drilling & Tapping Machine.

Designed for Small Parts Production Where Small Hole Drilling and Tapping is Required.

12 Spindle Drivers, 4 Speed Selections. T Track Vertical Feed Work Table.

Capable of Standard Center Distances down to .390, closer upon specific application.

- Head remains stationary while counter balanced table feeds work pieces up to drills or taps.
- Rapid changeover from one job to another. Well suited for either short or long runs.
- Work table features 2 "T" tracks, has adjustable depth stops. Depth controlled either mechanically or electrically.
- Standard spindle assemblies can be arranged in jig bored cluster plates to your prints, or used with adjustable arms. Over 35 standard spindle assemblies available to fit any job.

Overall Height 66"
Height from floor to Work Table 39"

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New Literature

the average roughness height are a few of the topics covered in a bulletin. Micrometrical Mfg. Co. **(Circle 523)** . . . Dials and verniers with arcs and segments accurate to 1 sec of arc; tapered spindles accurate to 0.00005 inch; level-vial assemblies with sensitivities ranging from 1 sec of arc per 2-mm division to 30 min; and alignment and other optical mechanical instrumentation devices are among the components discussed in a 24-page brochure. C. L. Berger & Sons, Inc. **(Circle 524)** . . . Dynamic balancing machines are designed for balancing parts weighing from 1 to 300 lb to accuracies of 0.000025 inch of displacement at the supporting bearings. Gisholt Machine Co. **(Circle 525)**

Lathes

Infinite spindle speed selection, constant horsepower and high torque are features of a lathe. Nebel Machine Tool Corp. **(Circle 526)** . . . All units for equipping a machine for extra operations are illustrated and described in a bulletin. Standard Electrical Tool Co. **(Circle 527)**

Lubricants, Coolants

Case histories show how companies have overcome metalworking production problems caused by contaminated coolant. Hoffman Industries, Inc. **(Circle 528)** . . . "Breaking Lubrication Barriers" discusses such barriers to effective lubrication as galling and seizing, extreme pressures, high friction, chemical reaction, temperature and extreme environments, and describes how solid lubricants can overcome them. Alpha-Molykote Corp. **(Circle 529)** . . . Eight soluble oils for metalworking operations are discussed in a bulletin. A guide to selection and dilution rates for specified machining operations is included. Shell Oil Co. **(Circle 530)**

Materials

"Light Metals Data" design data on the characteristics and properties of magnesium, aluminum and titanium. It lists comparative valves for various metals to assist in the selection of materials. Brooks & Perkins, Inc. **(Circle 531)** . . . A new steel can be heat-treated to an ultimate tensile strength of 360,000 psi, with a yield strength of 290,000 psi, a reduction of 20 to 30 percent and an elongation in 2 inches of 6 to 8 percent. Vanadium-Alloys Steel Co. **(Circle 532)** . . . "How To Heat Treat Armco 17-4 PH Stainless Steel" is the name of a data folder for engineers working with this precipitation hardening stainless steel grade.

Pick the one that's right for your job!

It pays to specify

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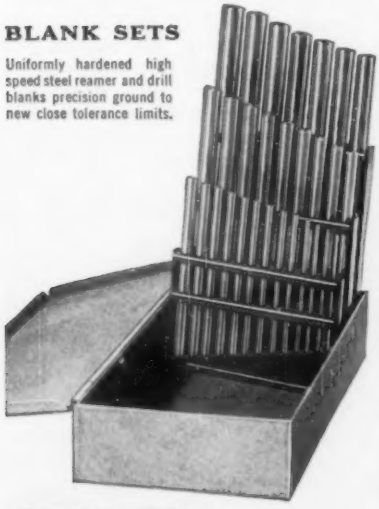
REAMERS
BLANKS

Carbide Tipped and Solid Carbide
Premium Quality High Speed Steel

BLANK SETS

Uniformly hardened high speed steel reamer and drill blanks precision ground to new close tolerance limits.



DRILL SETS

Standard stock sets include Fractional, Wire and Letter size drills, packaged in convenient folding index cases.

Call your local distributor today—or write Ace direct for latest catalog and price information.

ACE DRILL
Adrian, Michigan

ORIGINATORS OF "GROUND-FROM-THE-SOLID" DRILLS

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Armco Steel Corp. **(Circle 533)** . . . Using hollow stock for producing hollow parts results in reduced machining time, improved dimensional stability, closer tolerances and lower material costs. Aluminum Company of America. **(Circle 534)**

Materials Handling

Design and application information for a series of hinged steel belt chip removal conveyors that will fit all machine tools is given in a bulletin. May-Fran Mfg. Co. **(Circle 535)** . . . A pneumatic lift turntable with manually rotated custom conveyor section can be used for changing direction of flow or for lifting the conveyor section with its load and then rotating and lowering it. Specialty Equipment Corp. **(Circle 536)**

Milling

Several operations performed on electrohydraulic tracer mills are discussed in a 16-page catalog. Famco Machine Co. **(Circle 537)**

Welding, Soldering, Brazing

New products described in a catalog covering specialty products for welding, soldering and brazing are a silver brazing alloy with an extrusion coating which does not chip or char, and bronze alloys with microground flux coating. All-State Welding Alloys Co., Inc. **(Circle 538)** . . . Application hints for users of resistance welding apparatus and electrical and mechanical information on a nonsychronous welding control are given in a bulletin. General Electric Co. **(Circle 539)** . . . A bulletin describing four copper and copper based welding wires for the inert-gas welding processes gives procedures covering MIG and TIG welding methods. All-State Welding Alloys Co., Inc. **(Circle 540)** . . . A 220-volt, single-phase, 50/60-cycle spotwelder has a heavy-duty contactor and electronic timer to prevent the possibility of burning work and provide greater efficiency and economy in welding. Birdsell Products. **(Circle 541)** . . . A bulletin describes a line of resistance welding controls for spot, flash, projection, butt and seam welding applications. Also covered are Ignitron contactors and timers. General Electric Co. **(Circle 542)** . . . A plug-in function timer provides correct sequence control for all types of nonsynchronous welding from a single purpose gun welder to complex electrically or mechanically operated, automated machines or groups of welding machines. General Electric Co. **(Circle 543)** . . . A portable, resistance type spotwelder with built-in timer has a capacity of 3/16 inch for cold rolled

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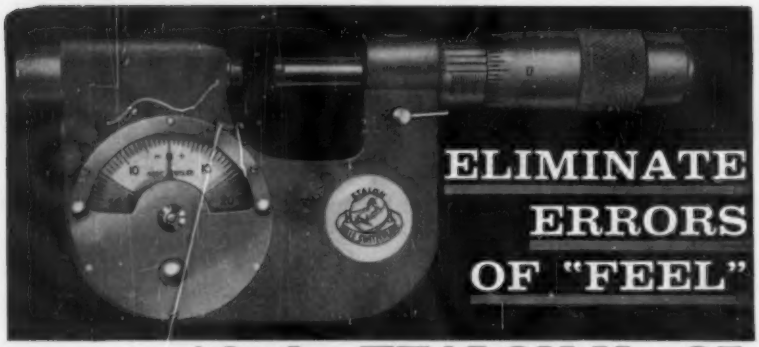

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The micrometer that measures and compares visually!

A rugged instrument designed to combine the precision of a dial indicator with the accuracy of the micrometer screw.

- Range 0 to 1".
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- Adjustable anvil pressure.
- To simplify fine adjustment, the dial can be rotated so that the "0" may always be placed under the hand.
- Built-in tolerance hands, individually adjustable: red for undersize, blue for oversize.
- Tungsten carbide measuring faces.
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NOW! A NEW METHOD FOR GRINDING TWIST, SUBLAND, STEP DRILLS AND SIMILAR 2, 3 & 4 LIPPED FORM TOOLS ACCURATELY AND ECONOMICALLY

WITH THE

CAWI-SPIRAL

MODEL N-4-90-Z

The new CAWI-SPIRAL not only resharpens any kind of drill point, it also produces pilot, multi-step, ball-shaped point drills, taps, end mills and similar cylindrical cutting tools with built-in radial and axial relief. All 2,3 or 4 lipped tools are ground by using a planetary gear head in one alternative and consecutive operation to achieve the symmetry of the drill point. Capacity: 1/16" to 2" diameter. Also available with web thinning attachment.

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CAWI MACHINE CO. INC.

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New Literature

steel and up to ⅛ inch combined thickness for stainless, galvanized and cadmium plated steel. Ace-Sycamore, Inc. **(Circle 544)** . . . A new series of flash butt welders can accommodate stock widths of 6 inches, stock diameters of 3 inches and diameters rings of 5 inches. Upset force up to 20,000 lb and clamp force up to 30,000 lb is provided at 80 psi line pressure. Sciaky Bros. Inc. **(Circle 545)** . . . A chart shows the basic welding symbols. Lenco, Inc. **(Circle 546)** . . . A pamphlet covering the advantages of brazing is entitled "Brazing Stainless Steel—How To Make the Most of It." Handy & Harman. **(Circle 547)** . . . Included in a catalog on arc welding machine accessories is a discussion of the ball-point cable connection on all products in the company's line. With it, a cable connection can be made anywhere in less than 2 min with a 7/32-inch hexagon wrench. Tweco Products, Inc. **(Circle 548)**

Workholders, Fixtures

Fifteen tool and workholding, indexing and positioning devices for boring machines are described in a catalog. Ex-Cell-O Corp. **(Circle 549)** . . . A line of sintered carbide products and die machinery includes wire puller jaws and inserts; round wire, bar and tube drawing dies; square and hexagon shape drawing dies; mandrel nibs; rough cored and semifinished heading die nibs; nail and tack tooling inserts; barbing laps and die finishing machinery. Firth Sterling, Inc. **(Circle 550)** . . . Using driving centers results in reduced setup time. With them, work can be machined from end to end with one setup, loaded and unloaded without stopping the machine, or held without preliminary machining of the end face. Power Grip, Inc. **(Circle 551)** . . . A folder describes a line of universal and independent type chucks. Kalamazoo Industries, Inc. **(Circle 552)** . . . Hydraulic expanding arbors, chucks and gages eliminate chucking errors and provide positive location by hydraulic expansion of arbors and male gages and hydraulic contraction of chucks and female gages. A. & C. Engrg. Co. **(Circle 553)** . . . Eight-position indexing toolholders for vertical boring and turning machines index four single point tools in 45-deg increments through a full 360 deg for boring, facing, turning, grooving and chamfering. Giddings & Lewis Machine Tool Co. **(Circle 554)** . . . Products presented in a catalog include arbors and sleeves for use with shank mounted tools; adjustable drawkeys; box type angle plates; and openside V-blocks. Giddings & Lewis Machine Tool Co. **(Circle 555)**

Men at Work

Election of Hobart D. Andreae to the board of directors has been announced by McIntosh Stamping Corp., Detroit, Mich. Andreae is president of Syncro Devices, Inc., Ferndale, and vice president of Syncro Corp., Oxford.

Charles B. Culbert, Jr., has been named eastern district sales manager for the welding products division of McKay Co. Since 1949, Culbert has been the company's sales representative in the New York territory. His new headquarters will be in New York.

Two new executive assignments have been announced by Martin Co., Baltimore, Md. Herbert A. May, Jr., has been appointed assistant to board chairman George M. Bunker and Roland Carlson has been advanced to replace May as assistant to president William B. Bergen. May, who has been associated since 1959 with Martin, was appointed assistant to the president in January of 1960. He was assistant to the president of Flight Refueling, Inc., before joining Martin. Carlson joined the firm in 1960 as a special assistant to the vice persident of corporate advanced program. He has also served as director of the advanced programs marketing data activities before his appointment as assistant to the president.

Richard T. Waits, Jr., has been appointed by Minneapolis-Honeywell Regulator Co. as eastern regional industrial manager with headquarters in Long Island City, N. Y. He succeeds D. W. Fryback. Waits joined Honeywell in 1945, serving successively in Atlanta, Ga., Charlotte, N. C., and Greenville, S. C. His most recent position was branch manager of North and South Carolina.

Owatonna Tool Co., Owatonna, Minn., has announced the promotion of Howard D. Haugen to the post of district manager for a newly created 10-county territory south of San Francisco, Calif. Haugen has had 10 years of industrial sales experience, much of which involved hydraulic and pneumatic components.

Loy C. Collingwood has been appointed by H. K. Porter Co., Inc., as manager of Alloy Metal Wire Works. This is one of the three plants of the company's Riverside-Alloy Metal Div. In his new position, Collingwood will be responsible for all activities concerning the Prospect Park, Pa., plant. For the past three years, he has been assistant general sales manager for Riverside-Alloy.

Leo Martin, retiring chief engineer for Western Gear Corp.'s industrial products division, has been named to a new post as special consultant for the firm. Martin is succeeded by Raymond W. Whelan, former sales manager at the Belmont, Calif., plant. Whelan began his career with the firm in 1947 as a test engineer. He was transferred to the commercial department in field service in 1951 and on to Belmont in 1959 to become sales manager of engineered products when the San Francisco area office was made headquarters of the division. James B. Post, Chicago district sales manager, has been advanced to the position formerly occupied by Whelan.

Henry H. Maltbie has been vice president and general manager of Specialty Valve, Trap & Controls Div., White Sewing Machine Corp. Maltbie has been associated with the Conneaut, Ohio, firm for the past 33 years and was appointed its general manager in 1959. He was assigned to his most recent post as general manager of McAlear Mfg. Co. when McAlear was acquired by White in 1960.

Top operating heads of two West Coast divisions were elected vice presidents of Parker-Hannifin Corp. They are W. C. Loeman, president of Parker Aircraft Co. Div., and S. A. Rogers, Jr., president of Parker Seal Co. Div. Loeman joined Parker-Hannifin in 1948 as an industrial engineer and was made manager of the company's industrial fittings division in 1953. A year later he was moved to Los Angeles as manager of Parker Aircraft's fitting divi-

M. C. Patterson (below) has been named president and treasurer of Saginaw Bearing Co. He was formerly Dodge Div. general manager and Chrysler Corp. vice president. He succeeds the son of the founder, William Agricola.

William J. Kerr (above), vice president of production for Yoder Co., Cleveland, has been assigned to the post of vice president of development. He will be responsible for product research and development programs.

Malcolm Hunt (below), vice president and director of sales for Macklin Co., has been promoted to the newly created post of assistant to the president. He will work on developing long-range policies and coordinate plans.

Charles J. Lantz (above) has been appointed director of production by Yoder Co. He will be responsible for all manufacturing operations carried on by the Cleveland, Ohio, metalworking machinery producer.

K. R. Beardslee (below), who retired last spring after serving as president of Carboloy Co., is now associated with Dawson Carbide Industries of Detroit and its affiliate, Harrisville Tool Co. of Harrisville, Mich.

sion. He later became vice president of manufacturing and then president. Rogers joined the corporation in 1948, was made manager of the Cleveland jet division in 1958, advanced to the position of manager of the rubber division in 1954 and, in 1958, was transferred to Culver City, Calif., as vice president of Parker Seal. He became president in 1959. Both Loeman and Rogers will retain their presidential duties along with their new assignments.

LeRoy J. Stoutenburg has joined Kline Mfg. Co., Galena, Ohio, as sales manager. He formerly served in this capacity in the hydraulics division of American Engineering Co. Previous to that, he was with Rivett Lathe and Grinder.

Appointment of Charles D. Michaelson as vice president of mining has been announced by Kennecott Copper Corp. Michaelson has been general manager of the western mining divisions with offices in Salt Lake City since 1955. As vice president, he will be located in the corporation's New York headquarters.

Sidney Aglow and Nathan Lavenda have been appointed national sales manager and sales manager, respectively, of the scale and tester division of John Chatillon & Sons, New York. Aglow was formerly East Coast regional sales manager. Lavenda has served in a number of sales and administrative capacities.

Carl J. Demrick has been promoted to the post of vice president in charge of manufacturing for all industrial divisions of Avis Industrial Corp., Detroit. Demrick is also president of the Hurd Lock Div. in Almont, Mich. Previously, he was president of Amplex Div., Chrysler Corp., and vice president in charge of manufacturing of Plymouth Div.

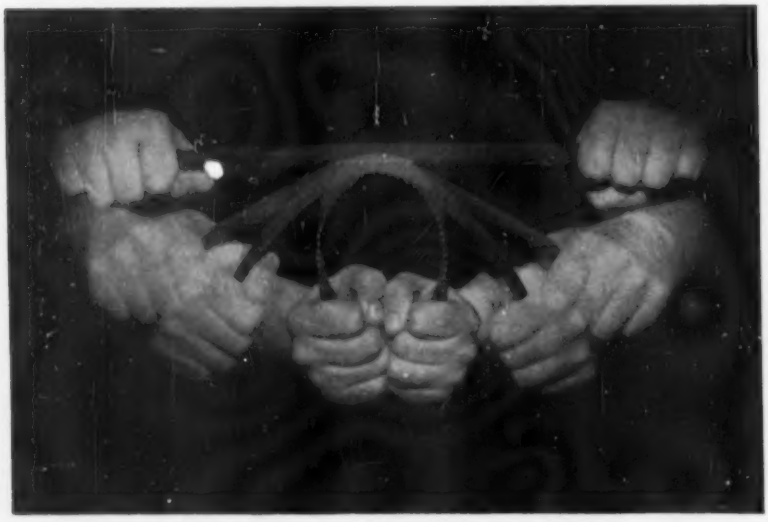
The appointment of Darwyn I. Brown as president of Seaway Steel Div. has been announced by Roblin-Seaway Industries, Inc. Previously, Brown was manager of product development of Washington Steel Corp. He also served at one time as an editor of *Iron Age*.

Named assistant to the president of Rocketdyne is D. E. Egan. Egan will assist President S. K. Hoffman on special assignments. For the past seven years, Egan has been sales manager of Kaiser Fleetwings, Inc., a subsidiary of Kaiser Industries.

W. Roderic Bliss has been named assistant director of research of Selas Corporation of America, Dresher, Pa. Bliss came to Selas from Martin Co., where he held the position of manager of industrial development on the corporate planning staff.

Robert J. Nelson has been appointed district manager of the eastern region for TRW Computers Co., a division of Thompson Ramo Wooldridge, Inc. He will be headquartered in New York. Prior to joining TRW, Nelson was associated with Informations Systems Inc. and, for 14 years before that he specialized in the application and sale of electrical and mechanical equipment for Westinghouse Electric Corp.

Malcolm M. Morgan has been promoted to the post of regional sales manager of the New England territory by Ultrasonics Industries, Inc. Morgan brings to the organization several years of experience in electromechanical and electro-optical sales engineering.



So it doesn't break---*So what??*

So we can bend a MARVEL High-Speed-Edge Hack Saw Blade double, and it won't break. Does this prove anything?

Let's see if it does. When you buy a box of hack saw blades, you expect each blade to have a reasonable cutting life. For example, take an ordinary blade that costs $4.00, and you expect it to produce 2000 sq. inches of accurate cutting-off before it is discarded. Would you be willing to pay $8.00 for that same blade? *You will, if it breaks halfway through its expected life.*

Bending a MARVEL High-Speed-Edge Hack Saw Blade to demonstrate that it is truly unbreakable proves the point that you get every square inch of blade life you pay for when you buy MARVEL Blades.

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Cost? Unbreakable MARVEL High-Speed-Edge Hack Saw Blades are priced competitively. Use MARVEL Blades consistently with complete confidence because they have no equal for value. Leading Industrial Distributors stock and sell MARVEL. Ask yours today.

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5700 West Bloomingdale Avenue • Chicago 39, Illinois

MARVEL SAWS

Use Reader Service Card, CIRCLE 84

B. E. Meyer has been named sales manager of the Hastings (Mich.), Div., E. W. Bliss Co. Meyer will supervise all sales of the company's complete line of metal-working presses in addition to the line of can-making machinery for which he is currently responsible. He succeeds Stanley E. Huffman.

The advancement of Russell L. Gilpin to the position of sales manager of the universal joint division has been announced by Dana Corp., Toledo. Gilpin joined Dana in 1954 as sales engineer. He entered the automotive industry as sales engineer with Engineering Reproductions, Inc.

Hugo Swan, a 13-year veteran in the machine tool building field, has joined Detroit Broach & Machine Co. as superintendent of the machine division. Until recently, Swan was operations manager of Brooks Research Inc. and, prior to that, was associated with Gleason Works.

Firth Sterling Inc., Pittsburgh, Pa., has announced the election of Charles R. Cox to its board of directors. In addition to handling his duties as director, Cox will consult on a part-time basis. He was formerly president of Kennecott Copper Corp.

General Electric Co.'s service shops department has appointed new managers for three of its 56 shops. R. W. Bingle has been named manager of the Portland, Ore., shop. D. H. Davis, former manager of the Fort Wayne, Ind., shop, will fill Bingle's former post at Charleston, W. Va. R. Z. Haney has been transferred to the Fort Wayne shop from the Toledo operation.

John D. Amoroso has been named by Basco, Inc., to the newly created position of general plant manager. His objective will be to coordinate the four-year-old company's manufacturing and engineering operations. Amoroso worked as plant manager and chief executive officer of Tube Manifold Corp.

John W. Thornton has been elected vice president and general manager of the industrial division of Joy Mfg. Co. He was formerly vice president in charge of marketing. Thornton joined the firm in 1957 after working for McKinsey & Co., Inc., in New York, and Brown Brothers Harriman and Co., Boston.

and as chief engineer of Buffalo Meter Co., Inc., before joining the North Tonawanda, N. Y., concern.

Three executive appointments have been announced by Link-Belt Co. Leslie J. Carson has been named director of engineering for the company with headquarters in Chicago. Roderick S. Galloway has been appointed general manager of the Colmar, Pa., plant, succeeding Carson. Galloway's successor, John M. Shepard, Jr., will assume the duties of general manager of the Atlanta, Ga., plant and the southeastern division.

New general manager of Hastings Div., E. W. Bliss Co., is Paul Jones. Jones was formerly factory manager of the division. He has been associated in the past with Continental Copper & Steel Industries, Inc., Borg-Warner Corp. and Bendix Aviation Corp.

The appointment of Frederick Olsen as plant superintendent has been announced by Baird Machine Co. Since 1955, Olsen has been toolroom superintendent for the Stratford, Conn., firm.

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MONTREAL — Humphrey E. Wallace
NEW HYDE PARK — The Eaton Company
NEW YORK CITY — J. V. Cromonin (Export)
PHILADELPHIA — General Tool Sales Co.
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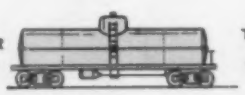

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technical shorts

Castable Material Resists CO Attack—A new refractory castable developed by The Babcock & Wilcox Co. Refractories Div. for use in blast furnaces has set a new high for resistance of castables to carbon monoxide disintegration. Although developed for blast furnace use, the castable—called Kaogun-BF—has applications in other metallurgical and chemical processes where CO atmospheres occur. With a use limit of 2800 F the material can be supplied to both inwall and topwall sections of blast furnace stacks in a matter of a few days as compared to the weeks required for rebricking. Gun application of the castable for interim repairs permits lower lining costs per ton of steel, and can possibly yield complete monolithic linings in a fraction of the time required to brick up a furnace.

Sintered Electrical Copper—Pilot runs of a new sintered copper developed by Electrical Contacts and Specialties Div., Fansteel Metallurgical Corp., have shown 10 percent savings in the production of contacts and other electrical components. Estimated savings are based on cost comparisons with parts made by forging or extrusion. Electrical conductivity of the sintered copper is 93 percent that of wrought copper. Yield is 36,000 psi as opposed to 40,000 psi for that of wrought copper.

Blackening Process—A blackening process developed by Du-Lite Chemical Corp. makes it possible to produce hard, dry, corrosion-resistant finishes on steel without making appreciable increases in the workpiece temperature. Called Orthox, the process involves the immersion of the work in a salt bath. In tests the process has provided finishes that exceed Government Specifications MIL-C-13924 A.

High Speed Molds—Development of a new polyurethane material that can be cured in three minutes has been disclosed by the Naugatuck Chemical Div., United States Rubber Co. Standard rubber fabricating machinery is used in processing the new elastomer. Because full physical properties can be obtained during the fast cure provided, the material is expected to effect significant economies in processing time.

New High-Strength Fasteners—Tension and shear bolts of a type used on advanced aircraft and missiles are now being produced by Standard Pressed Steel Co. Rated at 300,000 psi the fasteners were developed in response to a Department of Defense order calling for an increase in strength to 300,000 psi of steels not subject to brittle fracture. Availability of these components will make possible a 10 percent reduction in weight of landing gear assemblies

Bonded Diamonds: Precision Diamond Tool Co. of Elgin, Ill. has announced development of a new process for the bonding of diamond in grinding wheel applications. Attachment of the diamond to the bond is effected by chemical adhesion of the diamond to the bonding material. Previously, diamonds have been held in place by the locking action of the bond. This allowed far less than full utilization of the diamond since the particles escape as the bond wears. Reaction between new bond and diamond permits full utilization of all particles, however.

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This is an all new 1½" bar capacity ram type turret lathe with power feeds to all 8 working stations . . . that in addition to bar and collet work also has the versatility to do chucking, and when needed, single point threading. Powered by a 5 h.p., two-speed, geared motor, the new Sheldon 3 R turret lathe provides 16 spindle speeds, 60 different feeds to the carriage and cross-slide, and 180 different feeds to the ram turret.
The turret itself is ruggedly built and accurately machined to provide close tolerance indexing. And for complete ease of operation, it is put under power by simply pressing a push button on the control panel.

This new 3 R Sheldon is completely equipped with two-speed motor and electrical controls, coolant system and splash guards, LO spindle nose, large satin chrome dials and hardened bed ways. It also provides an additional cost saving feature—each turret face is drilled and tapped for your standard flange type tooling as well as being bored for your standard 1½" shank type tooling.
For versatile, accurate machining in either long or short runs, the new Sheldon 3 R provides the answer to low investment cost with high profit operation.

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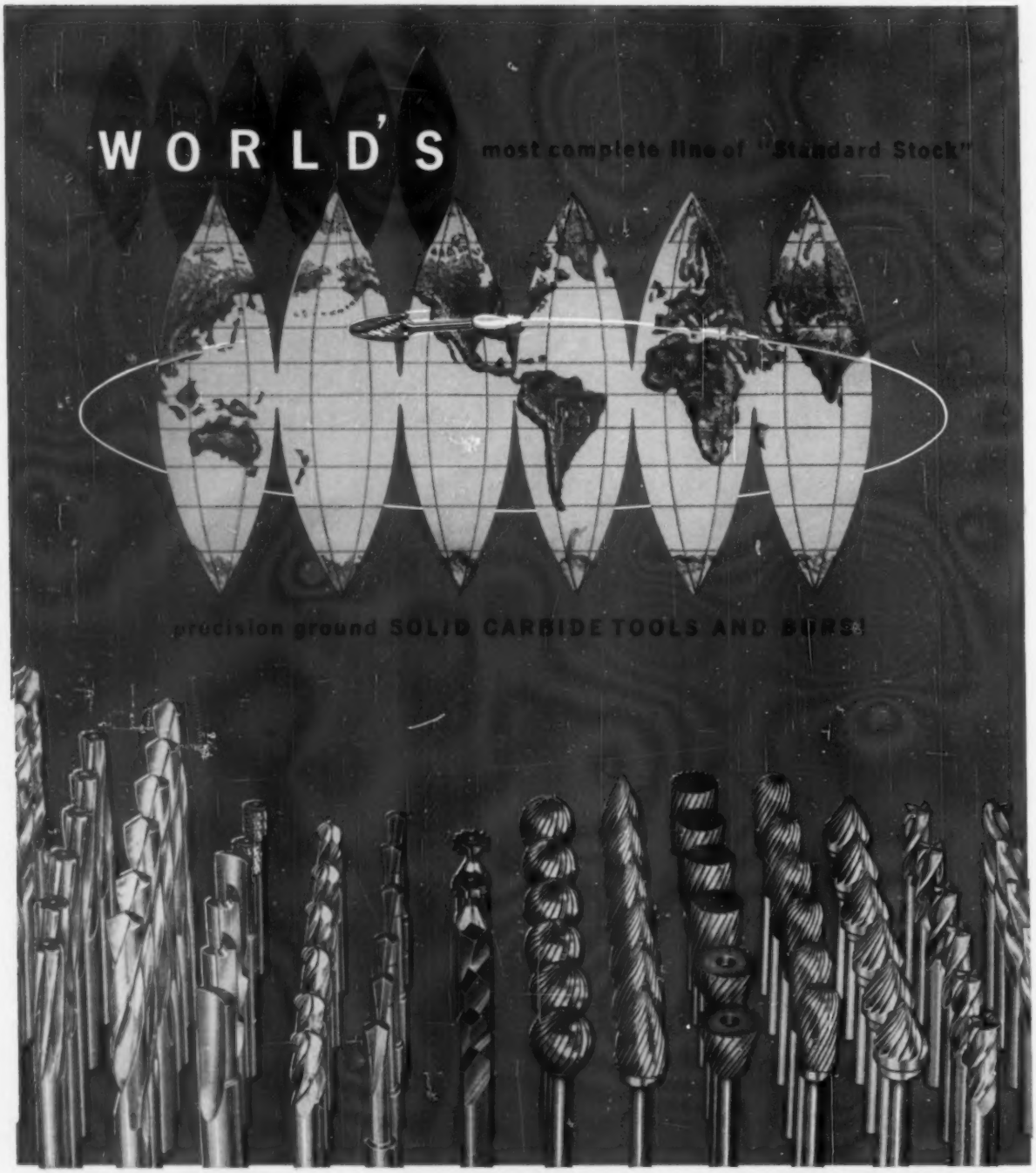

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readers' viewpoints

. . . numerical control

To the Editor:

Thank you for my copy of *Numerical Control Today*. It is the best work I have found to date on this subject. I hope you have no objection to my translating some of this material for publication in a Polish periodical . . .

Mr. Marian Zdrodowski
Warsazawa-Anin, ul. Zalipie No. 25
Poland

. . . professional registration

To the Editor:

With reference to the article on registration (Engineering Registration—Are National Standards Needed? September 1961), I have personally checked the examination papers for registration in the state of California and find them somewhat removed from the necessities of the engineering professions.

For example, on last year's test papers the applicants were required to answer questions on civil engineering, chemical engineering, electrical and mechanical engineering. Only after tests in these fields could the applicant take the examination for registration in his chosen field. . . .

To draw a parallel, it's somewhat like asking a bricklayer to take a test in carpentry before granting him a card.

I sincerely believe that Federal examinations should be given to all desiring registration as tool and manufacturing engineers—and it should be a tough one.

The Federal test should cover all phases of tool design, metallurgy, mathematics, gaging, inspection, and design and application of special machines and research machines as well as conventional machine tools.

However difficult this test might be, most tool and manufacturing engineers would approve of it and be willing to take it . . . but let's confine it to tool and manufacturing. There's really no point in mixing apples and oranges.

E. Purtha
Plant Manager
Plumas Tool & Instrument Mfg. Co.
Greenville, California

To the Editor:

The concept of professional registration betrays the very purpose for which it was intended. In my opinion, the title "Professional Engineer"—when used to designate one who has qualified by examination to practice within a limited field of engineering or technology—is erroneous.

Originally the purpose of registration was to insure the health and safety of the public—as in the licensing by the state of plumbers, electricians, boiler operators and those engaged in sewage disposal and water filtration. Licenses issued to these people do not carry any special misleading titles, however.

There is no reason for special limited phases of engineering to be treated differently. Most examinations leading to a Professional Engineer's license are based on textbook knowledge and can be passed only by recent college graduates who are lacking in experience—the essential ingredient in a good engineer.

The most damaging thing that the title of "Professional Engineer" has done is to create a caste system in the engineering profession. . . .

If the ferreting out of the irresponsible, inadequate or incompetent is not accomplished by the various methods now employed by industry, it is the duty of the engineering societies to address themselves to this problem. This should not be a function of government. Licensing is no guarantee against incompetence.

W. G. Bahr
Trenton, New Jersey

To the Editor:

What Mr. Smith seems to imply is that the laws should be changed to make it mandatory to provide less comprehensive and more specialized national standards that would be easier for certain groups to meet. Nothing could be more disastrous to the unity of the profession or more demeaning to any of the branches which might be created. It is not the purpose of registration to establish qualifications in the numerous special fields, but merely to establish the minimum levels of knowledge necessary to protect the public.

Uniformity of such laws, within limits of local conditions, is desirable but it is not a serious problem—as evidenced by the reciprocity between states. We have a model law, constantly revised and improved, and available as a guide to local legislatures when a real need for change can be demonstrated.

A popular fallacy presumes that registration is supposed to create another species of engineer, i.e., the Professional Engineer, while permissively continuing the coexistence of the lesser species of the original, nonregistered engineer. Nothing could be further from the truth. The clear intent and purpose, despite minor variations in the wordings used in various states, is to establish one, and only one, species which is known as the Professional Engineer. . . . Like lawyer and physicians, engineers no longer graduate as professionals—they become so by permission of the state.

The solution to the problem is simple, painless and quick. Stop the use of the word "engineer" in any form of nonregistered persons. The result? Instant professional status for the field of tool engineering and those who have a *bona fide* right to practice the profession.

Don R. King
Milwaukee, Wis.

One question: Does a state permit one whom it qualifies as an M.D. to practice legally all the specialties of the medical profession such as surgery, pathology, gynecology, pediatrics, psychiatry and radiology? If the states are truly concerned about the life and health of the public, I suspect that they insure that radiologists perform few, if any, neurosurgical operations. I might add that national standards for engineers can only be an expedient in the evolution of a true engineering profession.

Joseph B. Smith, Jr.
Harrisburg, Pa.

We regret that limitations of space do not permit us to include all of Messrs. Bahr's, King's and Smith's comments. —Ed.

. . . directory issue

To the Editor:

The TME directory has been of invaluable aid to me in my work assignment. Because we are frequently requested to investigate certain types of equipment . . . we must have readily available the closest local contact. To this end this particular issue has served us well.

C. R. Heinzen
The Emerson Electric Mfg. Co.
East St. Louis, Ill.

To the Editor:

I have received your directory issues with great enthusiasm and have found the material contained therein very helpful. However, I would like to suggest that the listings be expanded to include fabricating shops in the various parts of the country. . . .

Leonard Felicioni
General Electric Co.
Philadelphia, Pa.

To the Editor:

Please advise us as to how we may obtain a listing in the annual directory edition of THE TOOL AND MANUFACTURING ENGINEER.

C. S. Woodrow, Jr.
Gem Machine Co.
Dayton, Ohio

All requests for listings in the next issue should be directed to the Editor of THE TOOL AND MANUFACTURING ENGINEER. —Ed.

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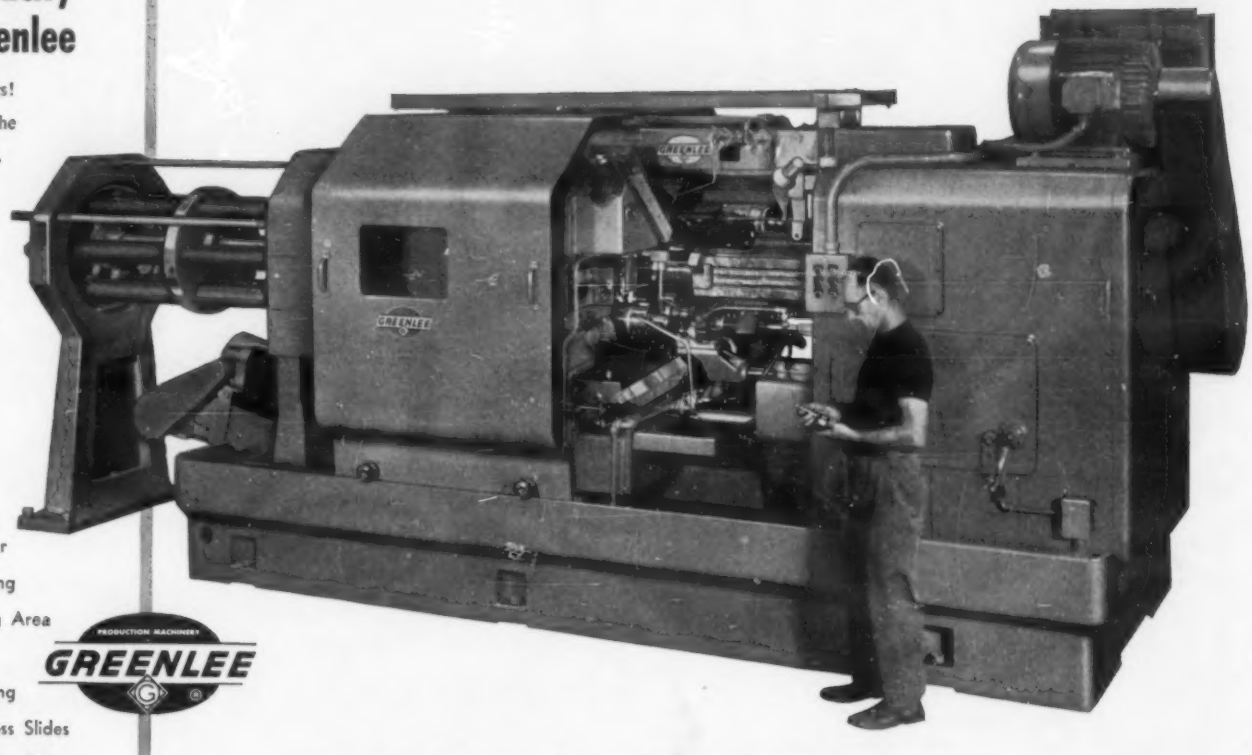

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21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140
141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160
161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180
181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220
221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240
241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260
261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280
281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300
301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320
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341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360
361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380
381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400

TOOLS OF TODAY DEPARTMENT INFORMATION

401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420
421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440
441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460
461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480
481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500

TRADE LITERATURE DEPARTMENT INFORMATION

501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520
521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540
541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560
561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580
581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600

TOOL CRIB SECTION INFORMATION

601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620
621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640

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Inside Front Cover 102 **Inside Back Cover 103** **Back Cover 104**

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TOOL ENGINEERING in Europe

By M. Kronenberg

Consulting Engineer
Cincinnati 6, Ohio

Vibratory Tool Grinding

Significant increase in the life of tools used in machining refractory materials is reported in Russia. This increase, recorded for both high-speed steel and carbide tools, is obtained by vibrating the tool at ultrasonic frequencies during grinding. Frequencies used are in the range of 22,000 cps, approximately twice as high as those used in similar experiments in the United States, and are developed by a magnetostrictive vibrator.

The increase in tool life is related to substantial improvement in surface finish of tools ground by the new technique.

Comparative life tests were run on tools ground with and without vibration. Material machined was a refractory alloy identified as Russian standard EI 437 B. Cutting speed of high-speed steel tools was between 26 and 32 fpm, with a depth of cut of 0.040 inch and a feed of 0.011 ipr. Greatest gain in tool life was obtained when machining at the higher cutting speeds. Life of high-speed steel tools increased as much as six times, or from 5 min for the conventionally ground tool to 30 min when the tool was ultrasonically vibrated during grinding. Life increase became lower as the machining speeds were lowered, but was never less than 100 percent above conventional grinding.

Carbide tool material tested was reported to contain 8 percent cobalt, and was probably sintered tungsten carbide with a cobalt binder. Life of tools of this material, ground with ultrasonic assistance, was about double that of the same material when conventionally ground. In two series of tests reported, comparative times were 22.4 min vs. 10.1 min, and 30.6 min vs. 14.9 min. Cutting speeds averaged 82 fpm. Depth of cut was 0.040 inch and feed, 0.011 ipr, the same as those used with tools made of high-speed steel.

A flank wear of 0.023 inch was set as criterion for end of tool life. This compares with American standards of 0.030 inch for high-speed steels and 0.015 inch for carbide tools. Difference between American and Russian standards should be considered when comparing American and Russian data. By our standards the Russian criterion is conservative as applied to high-speed steels, liberal as applied to carbide tools.

SOURCE: Voronin, A. A.; Markov, A. I.; Schercherback, M. A.—"The Effect on Cutting of Ultrasonic Vibration in Sharpening of Tools". *Machines and Tooling*, translated from *Stanki i Instrument*, Vol. 31, No. 2, 1961, p. 15.

Grinding Carbide Tools

In the grinding of sintered carbides, diamond grinding wheels give relatively short production time with desirable high surface finish.

Size, shape and density of diamonds vary and are a function of type of application. This also controls the bond used in manufacturing the wheel. Synthetic diamonds give better performance when the grinding wheel is resin bonded; natural diamonds are to be preferred in metal bonded wheels.

SOURCE: Wicher, G.—"Das Schleifen von Hartmetallen und hartmetallbestueckten Werkzeugen". *Klepsig Fachberichte*, Vol. 68, No. 6, p. 179.

Forces in Sheet Metal Punching

Unit cutting force required for punching of sheet metal is a direct function of the metal's tensile strength and an inverse function of its thickness. Neither is a linear function.

Ratio of shear strength to tensile strength is not fixed for any given metal, but varies with the thickness of the sheet. This ratio is important in computing the cutting force and the capacity of presses to perform the required punching operations.

Unit cutting force is not affected by tool clearance, even if extreme. Though the cutting force is affected by variations in punch diameter and impact speed, the changes are minimal and may be disregarded for all present purposes. In the future, however, impact speed may become more significant than it is now.

As an instance of current relationships between changes in impact speed and resulting unit cutting force, an increase in impact speed from 7 fpm to 38 fpm caused a change in unit cutting force from 68,000 psi to 78,000 psi. This means that a 440 percent increase in impact speed produced only a 15 percent increase in unit cutting force.

Changing the thickness of the sheet metal from 0.2 inch to 0.6 inch caused the ratio of shear strength to tensile strength to drop from a value of 0.89 to one of 0.78 for a sheet metal of 57,000-psi tensile strength.

While tool clearance has no effect on the unit cutting force, it does have a significant effect on the work done per unit hole area. In one instance the work done per unit hole area dropped from 1350 to 450 ft-lb per square inch as tool clearance was increased from 0.004 to 0.032 inch. Further increases in tool clearance had no more effect on work.

Return force is affected by punch build-up. Small clearances (2 to 4 percent) promote build-up with tough materials, but not with harder metals. Unit return cutting force drops as tool clearance goes up and, also, with the application of lubricants.

Also covered: equipment used in tests, strain gage instrumentation, materials tested, lubricants.

SOURCE: Eichhoff, W.—"Untersuchungen ueber den Kraft—und Arbeitsbedarf beim Lochen von Grobblechen". *Werkstatt und Betrieb*, Vol. 94, No. 7, 1961, p. 487.

Ceramic and Carbide Tools

While practical workshop experience shows that ceramic tools often have economic advantages over carbide tools, until now no research and test data were available to permit a quantitative evaluation of the advantage in terms of cost reduction, improved tool life and increased productivity resulting from higher cutting speeds.

Criteria by which improvement may be measured are suggested by two German engineers. The proposed criteria are: cutting force, friction force, chip compression and chip formation, all measured under identical conditions.

A new two-component cutting-force dynamometer was especially developed. Based on strain gages, it differs from those normally used in that the influence that the main cutting force exerts on the feed force was not deliberately discarded, but was used to improve calibration. Details of the technique are discussed.

Ceramic tools were made of pure aluminum oxide. Their microstructure, developed by Dawihl and Klingler, makes it possible to use these tools for roughing cuts.

Analysis of test data shows that cutting forces, friction forces and chip compression factor were lower with ceramic tools than with carbide tools. A comparison of these test results with the quantities given by using a number of different theoretical formulas showed that "Kronenberg's formulas for chip compression and main cutting forces give best agreement with the results obtained." These formulas are recommended for computing the indicated quantities when it is preferred not to

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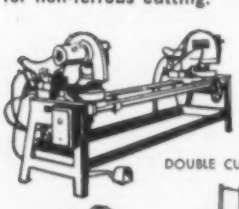
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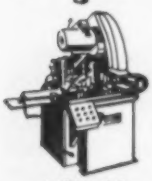
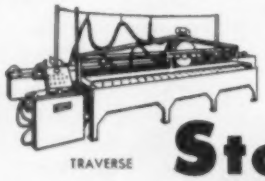

AUTOMATIC CHOP STROKE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establish them by actual test. They were published in THE TOOL ENGINEER, April 1958, page 89, and in the ASTE Collected Papers, Vol. 58, paper 86.

A better utilization of machine tools now in the shops is made possible by ceramic tools because of their lower cutting and friction forces. Chip compression is an important index of the magnitude of these forces. This reduction in the required forces allows increased cutting speed, and thus reduced production time, while remaining within the horsepower capacity of the drive motors. As an added bonus, the reduction in magnitude of the cutting forces improves machining accuracy because deformation of the machine tool is also reduced.

In the tests the cutting speed was varied between 100 fpm and 800 fpm, depth of cut was between 0.040 and 0.200 inch, and feed ranged between 0.004 and 0.020 ipr. Values obtained by computation agreed within 6 percent with those determined experimentally.

SOURCE: Altmeyer, G.; Krapf, H.—"Ueber Schnittkraft Messungen beim Drehen mit Aluminiumoxyd Schneidplatten". *Werkstattstechnik*, Vol. 51, No. 9, Sept. 1961, p. 459.

Grinding Wheel Wear

Accuracy of ground gear teeth is affected by differences induced in grinding wheel by wear, which becomes considerable when the gear has a great number of teeth and is of considerable width. Effect of wear is more pronounced in circular pitch distortion than in variation of tooth profile.

What is needed is either a mechanism that automatically compensates for grinding wheel wear, or a device that maintains the desired position of the grinding wheel's cutting edge relative to the gear tooth's geometry, especially depth.

In either case, easy dressing of the wheel at predetermined work intervals should be provided for.

Increasing the number of passes and the hardness of grinding wheels are also recommended.

SOURCE: Machitidze, A. V.—"The Effect of Grinding Wheel Wear on the Accuracy of Ground Gear Wheels". *Machines and Tooling*, translated from *Stanki i Instrument*, Vol. 31, No. 12, p. 14.

Grinding Carbide Dies

Best type of carbide for punching dies is identified as Russian standard WK 20, made of tungsten carbide with a cobalt binder. This material should be ground with diamond wheels having a grain size of 180 with 50 percent concentration in a Bakelite binder.

Ideal conditions for grinding dies made of this carbide are depth of cut of 0.001 inch, feed of about 10 fpm and peripheral wheel speed of 5800 fpm.

Also given: recommended feeds and speeds for diamond wheels with other concentrations and binders, effect of coolants, and relationship between wheel wear and metal removal for various concentrations and binders.

SOURCE: Gelfand, A. E.—"Diamond Machining of Carbide Components of Dies on Surface and Cylindrical Grinding Machines". *Machines and Tooling*, translated from *Stanki i Instrument*, Vol. 31, No. 12, p. 7.

Turning Noncircular Shapes

(1.) Number of noncircular parts produced on copying lathes is increasing to the point that it is now profitable to determine the conditions that must be satisfied in order to produce acceptable work. These conditions vary according to type of copying, including rotating-master and template, with mechanical or hydraulically controlled tracer fingers. Accordingly, a formula has been developed to determine maximum permissible rpm in copying-lathe turning of noncircular workpieces. Tracer errors for various types and shapes of workpieces have been determined.

(2.) Special attention should be paid to repeatable accuracy and surface finish of noncircular parts produced on copying lathes. During the rotation of the workpiece, tool angles are changing continuously, a condition that affects accuracy in an nonuniform manner. Accuracy is inversely proportional to the velocity and acceleration of the copying valve. Velocity is the product of the number of strokes per revolution of the workpiece by the number of workpiece revolutions per minute. Acceleration is a function of the forces acting on the piston divided by the inertia of the masses involved.

SOURCES: (1) Koehler, E.—"Kopierdrehen unrunder Werkstuecke". *Industrie Anzeiger*, No. IX, Sept. 1961, p. 1349. (2) Stau, C. H.—"Die Herstellung von unrunden Werkstuecken auf der Drehbank". *T. Z. fuer praktische Metallbearbeitung*, Vol. 55, No. 8, Aug. 1961, p. 428.

Hydraulic Vane Drive for Presses

Infinitely variable speed, remote control, and reduced production time are achieved on draw presses operated through a hydraulic vane drive. Typical cycle reduction is from 4 sec. to 2.3 sec.

Impact-free drawing is obtained at ram velocity of 120 fpm, as against 75 fpm with mehanical drives.

SOURCE: Boehringer, H.—"Hydraulischer Drehfluegel Antrieb fuer Kurbelpressen". *Werkstattstechnik*, Vol. 51, No. 9, Sept. 1961, p. 442.

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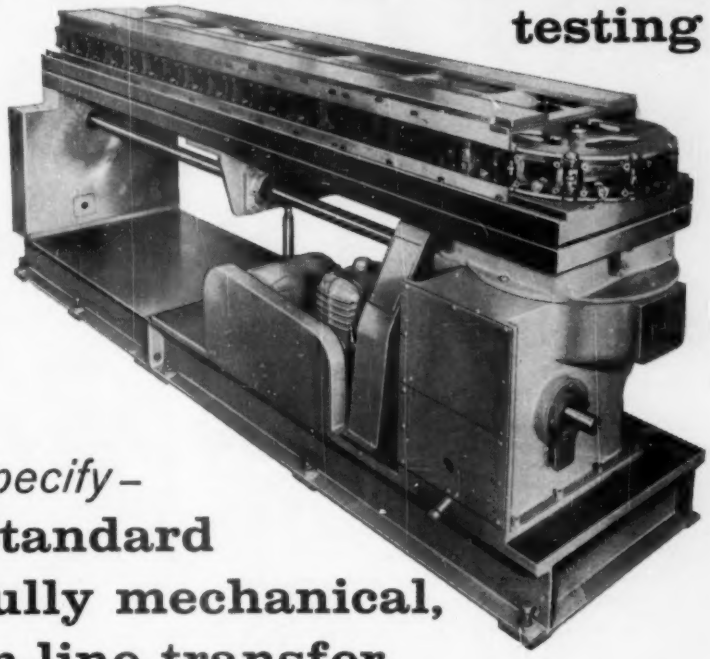

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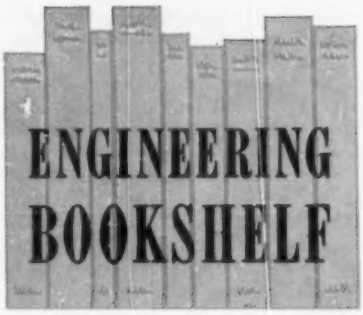

ENGINEERING PROFESSIONALISM IN INDUSTRY —*A Survey by Opinion Research Corp. for The Professional Engineers Conference Board for Industry in cooperation with The National Society of Professional Engineers. NSPE members, $2; non-members, $4. 104 pages.*

This booklet provides some interesting answers to the question, "How professional is the professional engineer?" Based on survey findings resulting from 350 personal interviews with engineers and top men in management, it discusses the engineer as he is seen by himself—and by his boss.

HANDBOOK OF THERMOPHYSICAL PROPERTIES OF SOLID MATERIAL—*Vols. 1, 2, 3, 4 and 5. Compiled by Alexander Goldsmith, Thomas E. Waterman, Harry J. Hirschhorn and Armour Research Foundation. The MacMillan Co. Price $90. 4300 pages.*

Compiled, prepared by and published under U. S. Air Force auspices, this handbook treats 12 important physical properties of solid materials. The first five—density, melting point, latent heat of fusion, latent heat of vaporization, latent heat of sublimation—are grouped together on individual reference sheets. The other seven—specific heat, thermal conductivity, thermal diffusivity, emissivity-reflectivity, linear thermal expansion, vapor pressure, and electric resistivity—are evaluated on separate data sheets and plotted on separate graphs as functions of temperature.

Vol. I—Discusses elements with melting points above 1000 F.

Vol. II—Discusses iron-base, copper-base, cobalt-base and refractory-base alloys, as well as light-metal and titanium alloys.

Vol. III—Discusses ceramics (oxide ceramics, mineral ceramics, vitreous structures, covalent ceramic structures, vitreous bonded crystalling ceramics, inorganic cements and adhesives).

Vol. IV—Discusses cermets, Intermetallics, polymeric materials and composite materials.

Vol. V—Discusses references and provides an author's guide.

A well-edited and definitive work on metals, this handbook is a valuable addition to the growing collection of literature on metals.

ENGINEERING MANAGEMENT AND ADMINISTRATION—*By Val Cronstedt. McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. Price $8.50. 350 pages.*

The engineering function at all levels is acquiring ever greater importance in the industrial scheme, as witness the rapid increase in the number of engineers as compared with production workers in all phases of industry. Engineering departments are common; engineering divisions are not unknown.

In this very growth lie the seeds of management problems of a new nature. No longer can there be the personal relationship that characterized a company's engineering family. In its stead there have grown tools, policies and practices for the management of the engineering function. These are presented effectively in this book.

In the organization of an engineering department there is the danger of regimentation, of destroying inidvidual initiative, and, too often, of undermining the professional status of engineers.

Managers will find here not only recommendations as to correct procedures, but also the reasons why many engineering department have a turnover not proportional to their size.

METALLIZING OF PLASTICS—*By Harold Narcus—Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. Price $5.50. 224 pages.*

Plastic metallizing both for decorative and functional purposes has received a large impetus in recent years, and, in turn, it has promoted the use of plastics in applications previously reserved for other materials.

To obtain the metallic surface required, there have arisen a variety of processes and techniques, each requiring specialized equipment.

This book is a practical approach to the problem of metallizing. It lists only those processes with which the author is thoroughly familiar for having used them in his own plant, but these cover the whole range from metal coating by chemical reduction through vacuum metallizing to electrodeposition and the catch-all miscellaneous metallizing methods.

All of these are treated from the practical point of view, showing type of equipment needed and giving actual formulations and operational details as needed.

MANAGEMENT GUIDE FOR SIMPLIFICATION—*By B. T. Lewis and W. W. Pearson. John F. Rider Publisher, Inc., 116 W. 14th St., New York 11, N. Y. Price $1.50. 71 pages.*

A practical presentation of ways to improve work methods and reduce waste, this guide also suggests means and techniques for analysis and evaluation of manufacturing methods.

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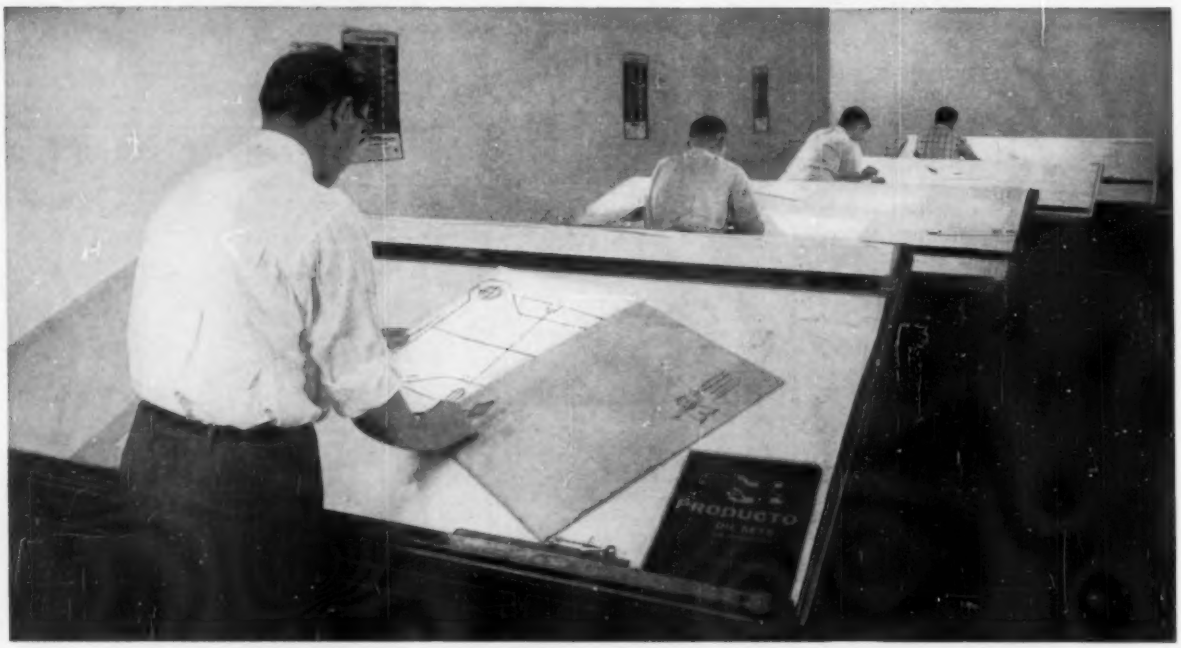

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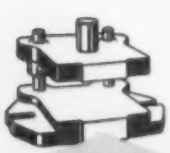

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Field Notes

TWO VICE PRESIDENTS of Metcut Research Associates Inc., Cincinnati, have been selected to give technical assistance to the Israeli metals industry. Acting through the International Cooperation Administration, U. S. Operations Mission to Israel, are John F. Kahles and Norman Zlatin. They will work with the Israel Institute of Metals in establishing a closer relationship between the Institute and Israel's 2000 enterprises concerned with metals by providing technical field service. Kahles, who is serving from October to January, is assisting in the solution of metallurgical problems. Zlatin, a mechanical engineer with broad experience in metalcutting and forming, will serve from January through May.

All patent, manufacturing and marketing rights to two automatic tube bending machines have been purchased by Baldwin-Lima-Hamilton Corp., Philadelphia. One model, originally designed by B-L-H, was to be manufactured by B-L-H and marketed by Nu-Era Corp., Rochester, Mich. The second machine was developed by Walter P. Hill, Inc., Detroit. . . . DuCas Corp., Providence, R. I., has been acquired by Taco Heaters, Inc., Cranston, R. I. DuCas manufactures fluid transfer glands for gun drilling applicatic for transferring fluids from a stat ary high-pressure line to a high-spee rotating line. The company will be operated as a subsidiary of Taco with headquarters at 1117 Douglas Ave., Providence. . . . Pall Corp., Glen Cove, N. Y., has acquired Vector Laboratories, Inc., Montreal. Vector specializes in solving problems of electromechanical and electronic control. While remaining president of the Canadian company, David J. Rosenberg will make his headquarters in Glen Cove, where he will assume the position of director of research and development for special products. Rosenberg formed Vector in 1957. . . . Two machining companies have been acquired by Mertronics Corp., Los Angeles. Assets and facilities of Acrosonics, Inc., and Hollywood Manufacturing and Supply Co., both located in Los Angeles, will be combined to form a new wholly owned subsidiary named Acronsonics Corp. The company will also operate a division known as Hollywood Manufacturing Div. Officers of Acrosonics are Francis H. Lewis, president; Dewel Morrison, vice president and general manager; Kenneth Boyd, treasurer; and Horace J. McAfee, secretary.

Acquisitions

The name of the American Society for Testing Materials has been changed to the American Society for Testing and Materials. . . . Slater Tools & Gages, Inc., is the recently adopted name of Paul B. Slater Co. The Los Angeles tool distributing firm handles cutting tools, abrasives, gages and tooling components. . . . George Rattray & Co., Inc., Hicksville, N. Y., a subsidiary of Instruments for Industry, Inc., has been renamed Raytron Electronics, Inc. The change was made to identify the company more closely with the brand name established by Raytron potentiometers . . . . Wallace E. Carroll, president of the American Gage & Machine group, has announced a new name for the company's woodworking machine affiliate, G. M. Diehl Machine Works, Inc. The title—Diehl Machines, Inc.—suggests more directly the continuing development of new tools and special production machinery at the Wabash, Ind., company. Charles W. Tuttle serves as president.

Name Changes

The formation of Forster/Hoover Electronics, Inc., has been announced by Hoover Ball and Bearing Co., Ann Arbor, Mich., and Institut Dr. Forster, Reutlingen, Germany. The new company will operate as a Hoover subsidiary to manufacture and sell electronic products developed by the German company. The subsidiary will have an engineering staff and manufacturing facilities for special application of eddy current and electromagnetic nondestructive testing instruments and magnetic field measurement equipment. The Instutut Dr. Forster was founded by Frederick Forster in 1948 as a research and development facility for nondestructive testing, magnetic field measurement, material research and dimension measurement.

New Companies

Bell & Howell Co. has established an electronics subsidiary near London which will assemble and manufacture data-processing equipment. The new company, Consolidated Electrodynamics Corp. (U. K.), Ltd., will market the entire line of data-processing instruments produced by Consolidated Electrodynamics Corp., Bell & Howell subsidiary in Pasadena, Calif. CEC (U.K.), Ltd., will also provide technical assistance to Elliott-Automation Ltd., which was licensed three years ago to manufacture and market CEC analytical and control instruments in certain British Commonwealth countries. Ronald F. Russ, former head of the transducer department at Solartron Electronics, Ltd., Farnborough, England, has been appointed general manager of the new company. . . . A wholly owned subsidiary, Nihon-Racine, has been formed in Tokyo by Racine Hydraulics & Machinery, Inc., Racine, Wis., to administer its hydraulic business in Japan and provide technical service. George B. Miller, executive vice president, and Gordon C. Fuller, international manager, together with K. Miyoshi, of Tokyo, will serve as directors of the subsidiary.

Expansions

Irvine B. Rabel, president of Star Machinery Co., Seattle, Wash., has been elected president of the American Machine Tool Distributors' Assn. During the past year, Rabel served as vice president of the association. Other key officers elected at the association's annual meeting included vice president, C. Denson Day, president of Machinery Associates, Inc., Wynnewood, Pa.; second vice president, William L. Walker, president of Walker Machinery Co., Cincinnati, Ohio; and secretary-treasurer, Robert W. Nissen, president of E. L. Essley Machinery Co., Chicago. Robert A. Brechter, Phil R. Hoffman and John L. Addy were elected to the executive committee. . . . A program to provide standards for general purpose machine tools, initiated two years ago, has gained the support of a group of machine tool builders and the U. S. Department of Defense. The Cooperative Machine Tool Standards

Association News

Field Notes

Group seeks to provide greater interchangeability of tooling through standardization. Current efforts are confined to drilling, grinding, milling and turning machines. To date, representatives of this group of builders and users, including the Defense Dept., have agreed on proposals for grinding and milling machines. The proposals will be submitted to the Office of Technical Services, U. S. Department of Commerce, for consideration as commercial standards. In accordance with Commerce Dept. procedure, the proposals will be circulated to industry and government for acceptance prior to printing as commercial standards. . . . A grant for $91,565 has been received by the Polytechnic Institute, Brooklyn, for a study in instability in liquid propellent rocket motors. Instability research has been conducted for more than seven years by the Institute's department of mechanical engineering under grants from the Air Force office of scientific research totaling $421,115. The research is under the direction of Vito Agosta . . . . Makers of wrought copper-metal mill products are accelerating their technical liaison with the automotive industry. This was announced by the Copper & Brass Research Assn. as it named Richard D. Chapman to head up the copper-mill industry's office in Detroit. Chapman joined CABRA in September after a 25-year career with Chrysler Corp. where he served as assistant chief engineer of basic sciences research. Chapman will make his headquarters at 19730 Ralston St. Later he will move to permanent offices which will house a technical library and exhibit of copper-mill products.

Elion Instruments, Inc., formerly located in Bristol, Pa., has consolidated all its activities in a new building. The company address is now Route U.S. 130, N., Burlington, N. J.

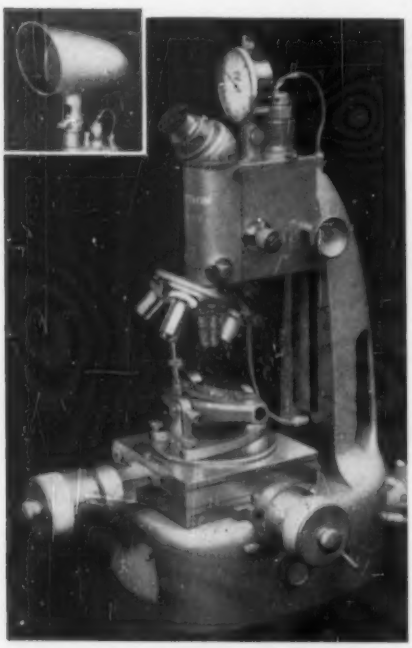
Moves

. . . Inductotherm Corp., manufacturer of high-frequency induction melting and heating equipment, has moved to a new plant at 10 Indel Ave., Rancocas, N. J. The firm was formerly located in Delanco, N. J. . . . Kearney & Trecker Corp., Milwaukee machine tool firm, will vacate its main plant facilities at 6800 W. National Ave. during the next year in a consolidation program which will see the company move its entire operation under one roof at the Hwy. 100 plant. The plant was built in 1952 to house the special machinery division established at that time. . . . The polishing stages of construction have been completed at the new headquarters of E & E Engineering, Inc., at 11941 Harper Ave., Detroit. The firm will soon be moving in. This 18-year-old engineering firm, headed by Edgar Geist, makes tooling accessories, jig and fixture components, manual and power industrial clamping devices, vacuum handling components, unique special-purpose cylinders, bushings and automation equipment.

Mergers

Martin-Marietta Corp. is the name of the enterprise formed by consolidating Martin Co. and American-Marietta Co. The new corporation will have sales of more than $1,200,000, two-thirds of which will be derived from defense and space business. The initial assets of Martin-Marietta will amount to almost $600,000,000 and the cash flow $75,000,000. George M. Bunker, Martin chairman, will be president and chief executive officer. Grover M. Hermann, founder and chairman of American-Marietta, will be chairman of the board of directors. . . . The board of directors of Cavitron Corp. has announced the merger of the corporation and its wholly owned subsidiary, Cavitron Equipment Corp. Name of the new

MEASURE TO 0.0001" IN 3 DIMENSIONS WITH UNITRON'S TOOLMAKERS MEASURING AND METALLURGICAL MICROSCOPE



The UNITRON Model TM is more than just a measuring microscope. It is the only instrument which combines in one stand a completely equipped toolmakers microscope for precise measurements — LENGTH, WIDTH and DEPTH, and a metallurgical microscope for examining the structure of polished metal samples under high magnification.

NOTE THESE QUALITY OPTICAL & MECHANICAL FEATURES

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- **Focusing:** Both dual control rack and pinion coarse and micrometer-screw type fine adjustments. Body has locking device.
- **Three Illuminators:** sub-stage, surface and vertical, have variable intensity.
- **Combination Stage:** rectangular ball bearing with linear measurements to 0.0001" and rotary measurements to 5' with vernier. (Metric model available on special order.)
- **Depth Indicator:** measures in units of 0.0001" by "optical contact" with specimen.
- **Projection Screen:** available as accessory for optical comparison.
- **Eyepiece Turret:** available as accessory for measuring surfaces, radii, thread pitch etc.

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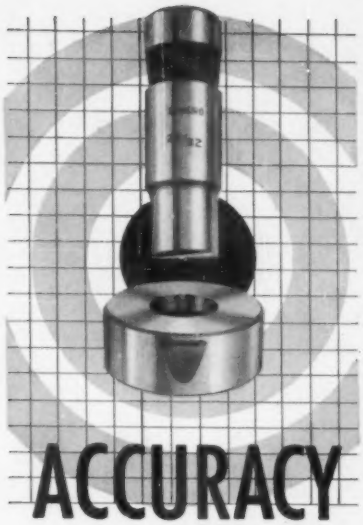

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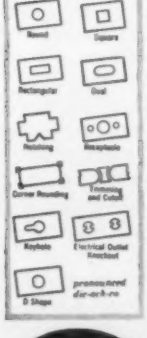
Accurate hole location is easily achieved with Di-Acro Precision Punch and Die sets because the centering point on the punch is ground concentric to the cutting edges, there is no "slop" even when several holes are punched in a blank. Hole sizes are accurate due both to the high degree of concentricity of the punch and die set and the choice of clearance which allows you to obtain clean, burr free holes no matter what material thickness is to be perforated. All Di-Acro punches and dies are precision made of high quality tool steel.

For multiple hole punching ask us about the new Di-Acro Adjustable Punches and Dies.



Over 500 standard sizes of Di-Acro Precision Punches and Dies in 12 standard styles are stocked. Punch Adapters and Die Holders are available to fit all styles of punch presses.

For extra convenience and savings order Di-Acro Punch Paks—fitted steel chests containing 24 and 30 sets of punches and dies.

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company is Cavitron Ultrasonics, Inc. Frederick L. Schuster serves as chairman of the board and president and Stanley M. Babson, Jr., is vice chairman and chief administrative officer. Arthur Kuris, former president of Cavitron Equipment Corp., is president of research and engineering. Carleton Ellis, Jr., former president of Cavitron Corp., has been named president of the special products division and Lewis Balamuth is vice president and director of research. . . . H. E. Martin, chairman of Metal & Thermit Corp., and L. K. Lindahl, chairman of Udylite Corp., Detroit, have announced approval by both boards of directors of a merger between the two companies. The action is subject to approval by the directors of a formal merger agreement for submission to the stockholders. Udylite will continue under its present management as a division of Metal & Thermit.

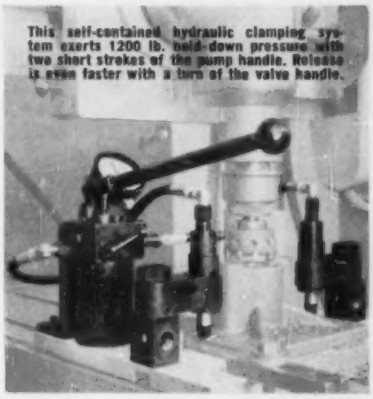
Awards

H. Thomas Hallowell, Jr., Standard Pressed Steel Co., Jenkintown, Pa., has been cited for outstanding service in the interest of standardization in an award made jointly by the Standards Engineers Society and the American Society for Testing and Materials. Hallowell is past president of the American Standards Assn. and presently a director and member of its executive committee.

New Activities

Hughes Tool Co.—manufacturer of drilling tools—has announced that it now offers compiete rebuilding services for machine tools and related equipment. The recently completed machine tool rebuilding unit at Hughes' plant in Houston, Tex., is designed to serve manufacturers in a 20-state area in the South and Southwest. . . . Cedar Engineering Div., Control Data Corp., has received a contract for over $230,000 from Raytheon Co., Lowell, Mass., for Sparrow III missile components. The components include miniature spin motors, gear motors and encapsulated solenoids. General manager T. G. Kamp stated that Cedar Engineering has been a supplier of electromechanical devices for this Navy air-to-air missile for more than three years. . . . To support the demand for components and electromechanical packages for the missile, computer and allied electronics fields, IMC Magnetics Corp., Westbury, N. Y., has established a special products engineering group at its western division in Maywood, Calif. IMC manufactures specialized air movers, motors, solenoids and valves. Kim Demetriou heads the group.

Hydraulic Clamping SLASHES Production Costs


This self-contained hydraulic clamping system exerts 1200 lb. hold-down pressure with two short strokes of the pump handle. Release is even faster with a turn of the valve handle.

NEWTON HYDRAULIC CLAMPING SPEEDS UP YOUR PRODUCTION . . .

Newton Systems permit rapid operation of many clamps simultaneously . . . just a matter of seconds compared with minutes by mechanical clamping. Let Newton Hydraulic Clamping Systems add new profits to your operations.

NEWTON HYDRAULIC SYSTEMS PROVIDE:

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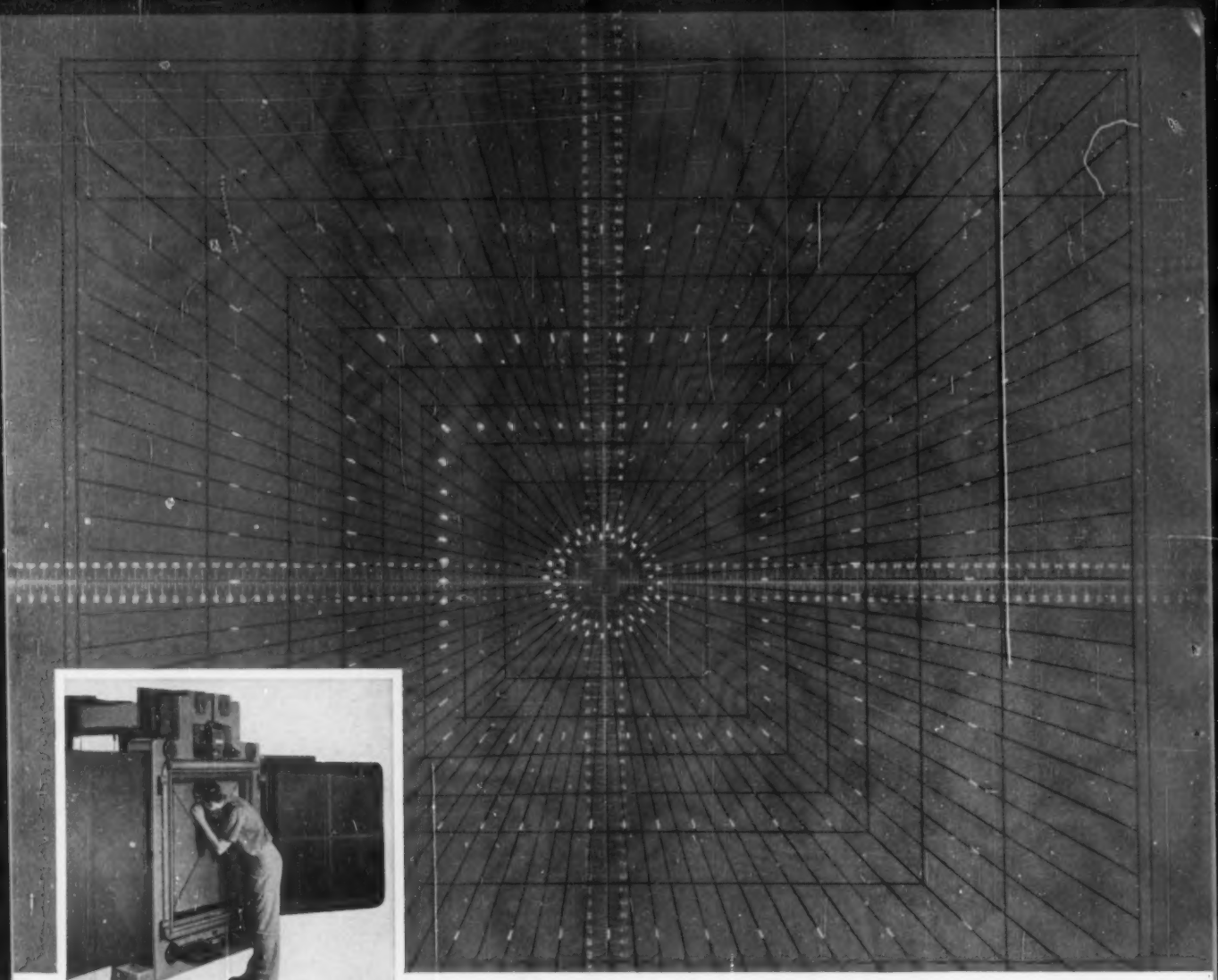

The large magnesium vacuum-plate is precision machined with 80 milled grooves and 80 drilled holes.

MACHINABILITY OF MAGNESIUM TOOLING PLATE

cuts production cost of giant film holders

46-inch-square vacuum film holders of magnesium tooling plate hold film and half-tone screens accurately in place in process cameras made by Robertson Photo-mechanix, Inc., Chicago.

WHY MAGNESIUM TOOLING PLATE? Unsurpassed machinability cuts the time and cost of precision-machining the 80 grooves and 80 holes in the plate . . . as-delivered flatness eliminates the need for surface machining . . . and light weight assures easy handling and accurate positioning of the holder in use.

Lightweight magnesium tooling plate offers these and many other advantages for tooling. It's the lightest of all structural metals, yet it's stiff and rigid. And being the easiest-to-machine metal, it reduces machining time and tool wear. New close thickness tolerances, flatness and high dimensional stability provide lasting accuracy, with minimum warping after machining.

Find out how lightweight, machinable magnesium tooling plate can cut your tooling fabrication and handling costs. Write THE DOW METAL PRODUCTS COMPANY, Midland, Michigan, Merchandising Dept. 1111FJ-12.

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who's meeting and where

Dec. 1. Society of Plastics Engineers, Inc. Technical conference on plastics screw injection molding. Cleveland Engineering Society Bldg., Cleveland, Ohio.

Dec. 3-7. Eastern joint computer conference sponsored by the Institute of Radio Engineers, the American Institute of Electrical Engineers and the Association for Computing Machinery. Sheraton-Park Hotel, Washington, D. C.

Dec. 4. Machine Knife Association annual meeting. Savoy-Hilton Hotel, New York City, N. Y.

Dec. 4-8. Workshop course entitled "Gas Shielded Arc Welding Processes" will cover the tungsten inert gas arc welding process. Hobart Brothers Technical School, Troy, Ohio.

Dec. 6-8. Electric furnace conference sponsored by the American Institute of Mining, Metallurgical and Petroleum Engineers and the Metallurgical Society. Penn-Sheraton Hotel, Pittsburg, Pa.

Dec. 11-13. Metal joining symposium dealing primarily with the fields of soldering, brazing and welding procedures and materials. Conference Center, Pennsylvania State University, University Park, Pa.

Dec. 18. Institute of the Aerospace Sciences. Wright Brothers lecture, Smithsonian Institute, Washington, D. C.

Dec. 19. Metal Cutting Knife Association annual meeting. Pittsburgh Hilton Hotel, Pittsburgh, Pa.

Dec. 26-31. American Association for the Advancement of Science. Annual meeting and exposition of science and industry. Denver Hilton Hotel, Denver, Colo.

Dec. 27-29. American Physical Society meeting. Los Angeles, Calif.

Dec. 27-30. American Statistical Association annual meeting. Roosevelt Hotel, New York, N. Y.

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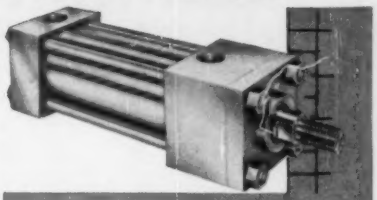

Air—(rated 200 psi)
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Meet JIC Standards 1 ½" to 14" Bores

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Made of the highest quality materials and seals, these new components combine modern design, the latest and best engineering advancements with O-M specialized "know how" and precision workmanship.

New Series "K" Air Cylinders

Construction features include brass cylinder barrel, chrome-plated, high tensile steel piston rod with a minimum yield strength of 90,000 to 100,000 psi. Rolled and machined steel heads and extra long cartridge-type rod bearing assure perfect alignment of piston rod.

New Series "L" Hydraulic Cylinders

Similar in many construction features to Series "K", but specifically designed for hydraulic service. Incorporate vee-type rod packing and a cylinder barrel of micro-honed steel tubing which are best suited for hydraulic operations.

With the addition of the new Series "K" and "L" to the Ortman-Miller major line of air and hydraulic cylinders, you can now rely on O-M for *all* of your low and medium pressure cylinder requirements.

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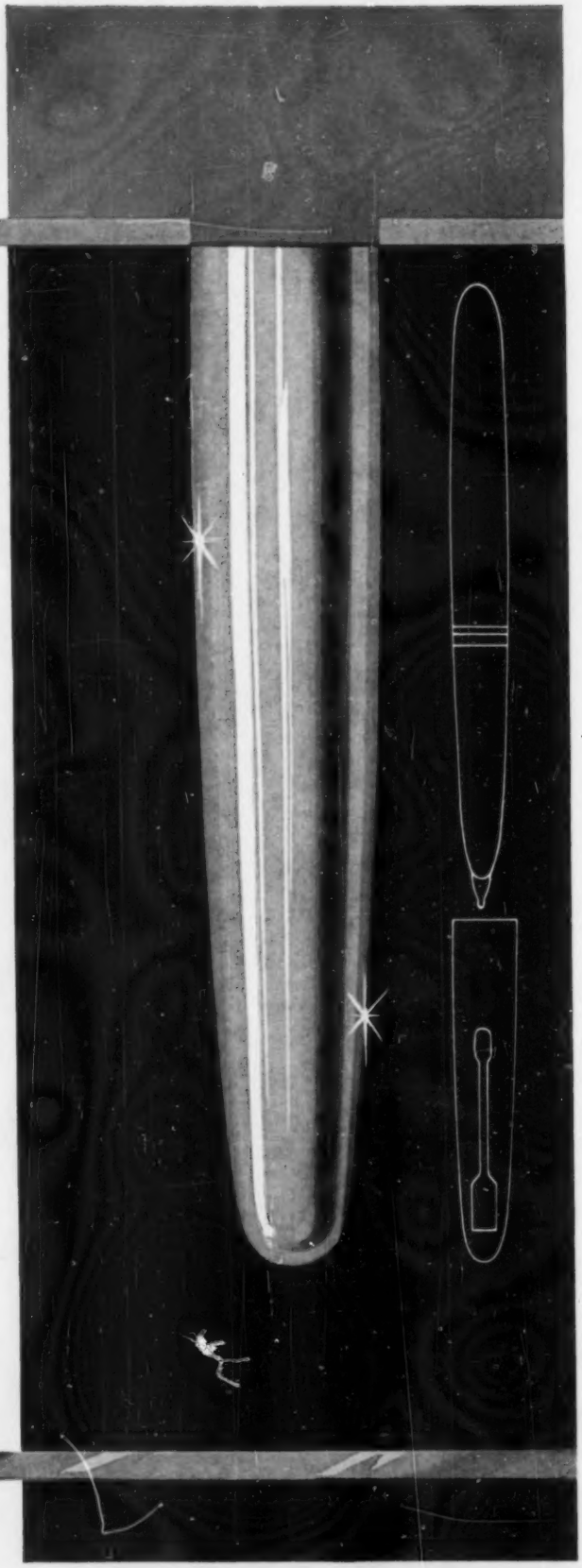

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Tech Digests

Management Problems—Lease, Purchase or Make

Lease financing is not really new, but in our recent economic environment it has assumed a major role in supplementing or, in some situations, actually replacing the traditional equity financing and purchase of assets. Capital assets financed by leasing have been characterized as "rented capital" but, however regarded, the method has added an additional approach for raising capital.

Although at one time the terms "sale and leaseback" and "lease financing" were confined mainly to real estate, it now appears that any type of capital asset may be rented within the patterns already well established for trucks and automotive units, railroad cars, oil tankers, heavy production equipment, aircraft engines and others. Even the Federal Government has succumbed to this program by renting post offices throughout the country, completely breaking the old test of permanency as a criterion for buying rather than renting. One of the largest U.S. corporations in terms of assets holds no new property in ownership but utilizes the leaseback procedure completely. Of course, in the office-equipment industry computers are almost always rented.

There is no doubt that "sale and leaseback" has been popularized with the hue and cry, "Why buy a cow when milk is so cheap?" The chief attractions are (1) a gain in working capital and capital for business expansion, and (2) improvement on corporate tax deductions. A valid leasing arrangement permits a company to charge rental payments as expense over the basic term of the lease. This may exceed the depreciation write-off rate, particularly if an accelerated depreciation method is not being employed. The result is not actually a tax saving but a shift in the timing of deductions and tax payments similar to the effect of accelerated depreciation. To the extent that tax payments are deferred, the company benefits by having the use of these funds for the additional period of deferment. Also, leasing makes it possible to write off land values against taxable income, a practice which is not allowed for depreciation purposes. The effect can be quite significant where land is a substantial portion of the total investment, although this may or may not be an advantage.

Much has been written concerning the pros and cons of leasing. Unfortunately, some of what has been written, and widely read, has been presented by persons who are in the business of leasing. Others have been more critical; and as Donald Gant concludes that, in some cases, the illusion of lease financing offers the lessee "the rather questionable privilege of being able to abandon a property it has already paid for."

Where the flexibility of a lease actually provides flexibility, where a tax advantage is offered for current, complete write-off to expenses, or where the freeing of capital for more lucrative investment is helpful, leasing may be the answer which should receive the call over purchase. In any event the "theory of present value" must be considered in establishing a true rate of return of investment versus the overall cost of leasing. Management must determine that the price is really, not just apparently, cheap.

Professor Anthony and others have developed procedural formulas and tables for determining the relative merits of purchase versus lease. Computer manufacturers have developed computer programs and routines which, with information peculiar to the customers' tax and other variable factors, calculate the pay-out period for various situations.

Today in more versatile industries management is confronted with the question of "rent, buy, or *build*."

Again, no position has been taken as to whether the current enthusiasm for leasing is real progress in financial practices or whether it is a passing fad. Financial experts, accountants, tax men, and management in general have voiced many views ranging from full acceptance to blanket denunciation as a snare and delusion. In any event it is a new tool for management, and one that must not be ignored in view of the high cost of capital and taxes.

From a paper "Practices in General Management—Financial" by R. B. Curry, vice president and comptroller, Southern Railway Co., Washington, D. C., presented at the Winter Annual Meeting of the American Society of Mechanical Engineers, 1960.

Obsolete Machine Tools

It can be said of both the electrical industry and the machine tool industry that they are key elements of our national strength; they are where the big hope for progress lies; they are doing amazing things now and there is no limit to the things they will do in the future. These two industries met some thirty years ago in the electromechanical control of machine tools, and their partnership since that time has reshaped the American economy.

In the years ahead, the partnership must do more than further reshape the economy. It is no exaggeration to say that it must be used to preserve the American system.

We are, both of us—your industry and mine—deeply affected by the problems of the national economy, and by the solutions chosen to meet those problems. And so I should like to talk for a moment on this theme.

As businessmen, our thoughts and actions are being dominated today by the economic fact of continuously rising costs. The rise has been especially steep in labor costs. Between 1940 and 1959, for example, the cost of an hour's work for a typical United States Steel em-

ployee rose from 94 cents to four dollars. That is an increase of about 8 per cent per year, compounded.

As a result of rising costs, many companies are conducting their business at a break-even point which demands a very high level of operations—a level considerably above that which the companies can hope to maintain through the entire business cycle.

Another dominating fact of our times is the surplus of production facilities which American industry has now built up in practically every field of manufacturing.

For some industries, the problems of under-used facilities, rising costs and unemployment of their workers are being compounded by the competition of low-cost, low-price imports. Let me give you one example outside our own industries. The American Iron and Steel Institute figures revealed that 28 percent of all the reinforcing steel bars used in this country in 1959 were foreign made.

There is no reason to believe that these trends will slow down, much less reverse themselves. This means that for the foreseeable future, business will be operating in a particularly difficult economic climate. Costs will continue to rise. Competition, both foreign and domestic, will continue to exert pressure on prices. Profits will continue to be squeezed.

There is no single, simple, easy solution to such complex problems as these. There are many things we should and must do to expand and create domestic markets, regain foreign markets, quicken consumption, speed up economic growth, create jobs, and put excess capacity to work.

Part of the answer lies in research. Part of it lies in the development of new products and new markets to provide jobs for displaced employees. Also, there is a need for improved and extended education of our young. We need reform of tax laws to provide better incentives for risk capital. We must also strive to improve the management of our businesses.

TO REQUEST COMPLETE PAPERS WRITE TO THE ADDRESS AND ORGANIZATION INDICATED AT THE END OF EACH ABSTRACT

All of these answers are important; but near the top of any list must stand the first principle by which the American economy has grown and prospered. It is simply this: to keep costs and prices down, and sales up, by continually improving economic performance through better equipment, facilities, plants, methods, and products. And this, of course, brings us to what may be the two biggest words in the English language today: productivity, and automation.

From an address by Mark W. Cresap, Jr., president, Westinghouse Electric Corp. Presented at the 1961 Machine Tool Forum, Pittsburgh, Pa.

Lower Costs Through High-Strength Steels

Because the relative increase in price of higher strength steels (compared with the price of structural carbon steel) is less than the relative increase in yield point, the application of higher strength steels results in lighter weight structures often accompanied by material-cost savings.

Tension members show weight savings up to 67 percent (for the "T-1" steels), with material-cost savings up to 32 percent for members built-up from "T-1" type A steel plates. For rolled shapes the maximum material-cost savings is 24 percent for A440 steel shapes.

For rolled beams with equal web depth-to-thickness ratios, the maximum

Continued on page 155

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BATH *Tap'n Gage* TIMES

A series of technical discussions that will be helpful in getting better results from tapping and gaging operations

Vol. 1 No. 22

Subject: Popular Series Taps for Blind Hole Tapping Aluminum, Magnesium and Die Castings.

Bath has developed a series of popular size taps to give maximum performance in aluminum, magnesium and die castings. The increased use of these materials for production parts such as engine blocks and other components makes it desirable to use taps designed for these particular applications.

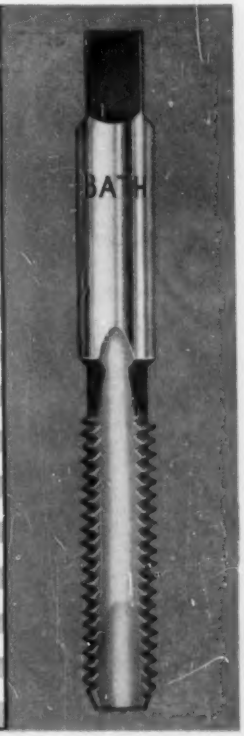
These taps, available from stock, have a special flute form and angle, ground after thread grinding and designated — Deepened Flute, Extra Hook. This assures a keen cutting edge — will remove, not push material — avoids "closing in" on Go thread gage. An abrasion resisting surface treatment prolongs tap life.

Users specifying Spiral Fluted taps for these applications will find that Bath Deepened Flute Extra Hook Taps outperform them in many instances and sell for 30% less. These taps can also be used for through holes but a spiral point is generally preferable.

Convince yourself that Bath Deepened Flute Extra Hook Taps for blind hole tapping aluminum, magnesium and die castings are superior. Take advantage of our offer and try a Bath Tap on this type of application — and see the difference!

Listed in the table below are some of the standard sizes and pitch diameter tolerances available from stock.

Tap Size	Threads per inch		Basic Major Diameter	Basic Pitch Diameter	Standard Pitch Diameter Tolerances					Number of Flutes	Length Overall	Thread Length
	NC UNC	NF UNF										
#3	48		.099	.0855	H1	H2				2	1 13/16	1/2
#3		56	.099	.0874	H1	H2				2	1 13/16	1/2
#4	40		.112	.0958	H1	H2				2	1 7/8	9/16
#4		48	.112	.0985	H1	H2				2	1 7/8	9/16
#5	40		.125	.1088	H1	H2				2	1 15/16	5/8
#5		44	.125	.1102	H1	H2				2	1 15/16	5/8
#6	32		.138	.1177	H1	H2	H3			2	2	11/16
#6		40	.138	.1218	H1	H2				2	2	11/16
#8	32		.164	.1437	H1	H2	H3			2	2 1/8	3/4
#8		36	.164	.1460	H1	H2				2	2 1/8	3/4
#10	24		.190	.1629	H1	H2	H3			2	2 3/8	7/8
#10		32	.190	.1697	H1	H2	H3			2	2 3/8	7/8
#12	24		.216	.1889	H1		H3			2	2 3/8	15/16
#12		28	.216	.1928	H1		H3			2	2 3/8	15/16
1/4	20		.250	.2175	H1	H2	H3		H5	2	2 1/2	1
1/4		28	.250	.2268	H1	H2	H3	H4		2	2 1/2	1
5/16	18		.3125	.2764	H1	H2	H3		H5	2	2 23/32	1 1/8
5/16		24	.3125	.2854	H1	H2	H3	H4		2	2 23/32	1 1/8
3/8	16		.375	.3344	H1	H2	H3		H5	3	2 15/16	1 1/4
3/8		24	.375	.3479	H1	H2	H3	H4		4	2 15/16	1 1/4
7/16	14		.4375	.3911			H3			3	3 5/32	1 7/16
7/16		20	.4375	.4050	H1	H2	H3		H5	4	3 5/32	1 7/16
1/2	13		.500	.4500	H1	H2	H3		H5	4	3 3/8	1 21/32
1/2		20	.500	.4675	H1	H2	H3		H5	4	3 3/8	1 21/32
9/16	12		.5625	.5084	H1	H2	H3		H5	4	3 15/32	1 21/32
9/16		18	.5625	.5264	H1	H2	H3		H5	4	3 15/32	1 21/32
5/8	11		.625	.5660	H1	H2	H3		H5	4	3 13/16	1 13/16
5/8		18	.625	.5889	H1	H2	H3		H5	4	3 13/16	1 13/16



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weight savings are obtained for the "T-1" steels (52 percent). Material-cost savings are shown by A440 steel (12 percent). For girders in which the web depth-to-thickness ratios are limited by buckling, weight savings are accompanied by an increase in material cost for short spans, but for longer span girders the material-cost savings become again significant.

Hybrid steel beams that are built up by welding higher strength steel flanges to lower strength steel webs show both weight and material-cost savings in all combinations investigated. For example, a hybrid steel beam with an A7 steel web (33,000-psi yield) and "T-1" type A steel flanges (100,000-psi yield) shows a 15 percent material-cost saving and a 37 percent weight saving.

From a paper "Lighter Weight and Lower Cost Achieved with Stronger Steels" by Dr. G. Haaijer, assistant division chief, Applied Research Laboratory, United States Steel Corp., presented at the United States Steel Corp.'s Steel Design and Engineering Seminar.

Schools and Colleges

Management of educational institutions in the Fifties was dominated by two major conditions: The beginning of an almost explosive growth in enrollments; and the rising costs of operation coupled with attempts to bring faculty salaries up to levels more nearly competitive with industry.

In the elementary schools and high school systems the "baby boom" of the latter half of the 1940's began a progressive wave of increased enrollments grade by grade and also in total, reaching the junior high school level by the

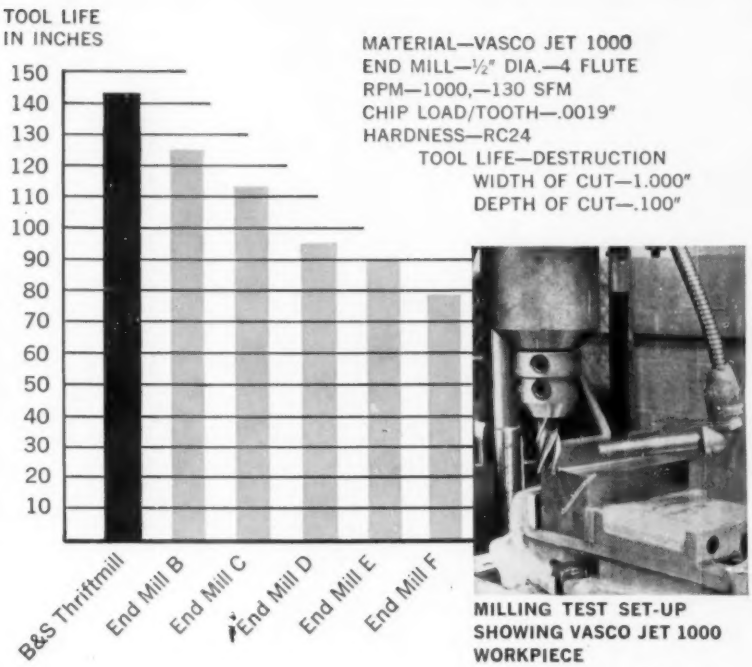
TO REQUEST COMPLETE PAPERS WRITE TO THE ADDRESS AND ORGANIZATION INDICATED AT THE END OF EACH ABSTRACT

end of the decade. The continuing higher birth rate, above the prewar level, indicates that this trend will continue through the next two decades.

At the college level enrollments were swollen by the larger percentage of high school graduates going on to college because of the increasing opportunities in industry for college graduates. A large number of these students were enabled to continue their education under the provisions of the GI Bill and by means of scholarships. In urban college centers night-school enrollments also skyrocketed because of the demand for college educated people in industry. Many companies made available tuition aid to employees who enrolled in such courses leading to degrees.

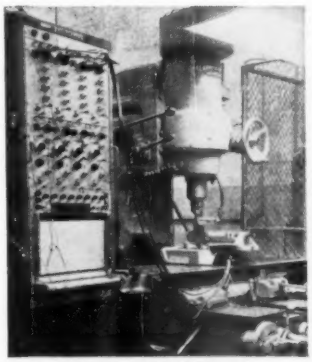
As a consequence of the swelling enrollments, facilities expansion and in-

Continued on page 158



MILLING TEST SET-UP SHOWING VASCO JET 1000 WORKPIECE

B&S Thriftmill® wins tooling torture test at North American Aviation!



8 CHANNEL RECORDER, DYNAMOMETER AND MILL.

Thriftmill cuts Vasco Jet 1000 Steel . . . 142 inches at 130 Surface feet/minute.

It is interesting to note that the best tool life of 142" at 130 SFM produced complete break down destruction of cutter, but in later tests, on the same hardness of material, 2016" of tool life with only a .010" wear land was acquired at a more normal speed of 43 SFM.

This (Thriftmill) cutter is unique from others in this series of tests for the reasons that it is cheaper to purchase than standard cutters and its geometry is quite different.

Of course, this is what B&S has been saying all along— THRIFTMILLS ARE DIFFERENT!

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End Your Tool Steel Problems with the A-L STEELECTOR System

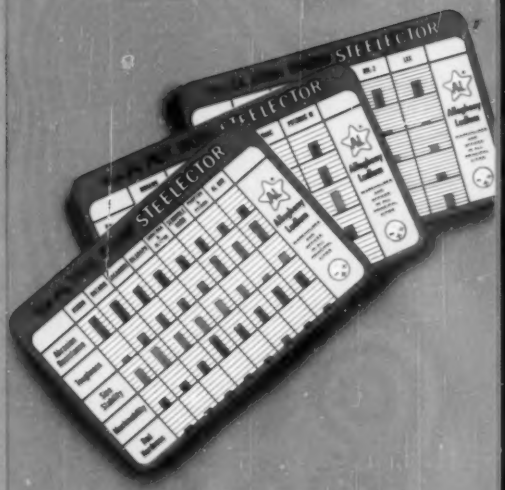
STEELECTOR

Save Selection Time, Insure Accuracy, Cut Inventory Costs

If you started using the new Allegheny Ludlum STEELECTOR Program first introduced last year, you know what savings it can bring. If you didn't, your competitors may have stolen a march on you.

There are many advantages in the STEELECTOR system. Perhaps most important is the savings in selection time. No longer need anyone spend hours in tool steel selection. By using one of the STEELECTOR Cards, an accurate selection can be made virtually at a glance. In seconds you can choose the tool steel grade with the particular combination of red hardness, abrasion resistance, size stability, toughness, and machinability required by the job at hand.

You can select STEELECTOR tool steels with confidence—they are always in stock. You don't have to stockpile tool steel. Instead, by relying on Allegheny Ludlum material and using STEELECTOR grades, you can reduce the variety of tool steels in your inventory. You reduce problems because the STEELECTOR offers the tool steels that are right for your jobs, eliminates those that contribute nothing but confusion.



STEELECTOR Cards Save Selection Time

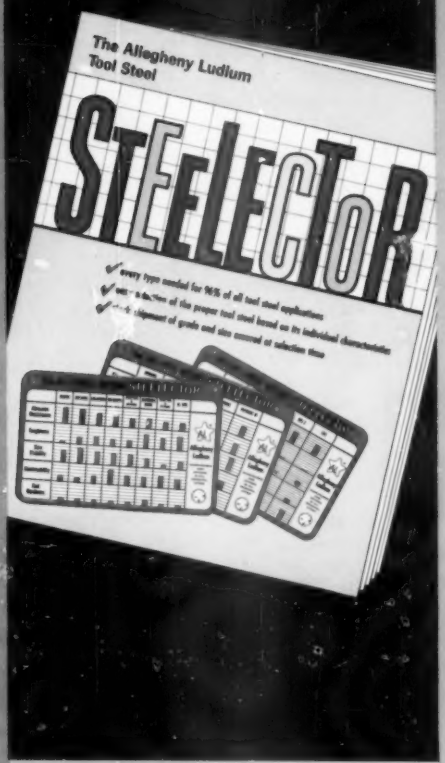
The three STEELECTOR Cards insure that you will pick the right tool steel for every application. Each STEELECTOR Card (there are cards for tool room, hot work, and high speed applications) uses bar graphs to indicate the relative abrasion resistance, toughness, size stability, machinability, and red hardness of the STEELECTOR grades. You can select the best combination of properties for the job at hand virtually at a glance.

STEELECTOR tool steels will meet your job requirements. You can clean house with the STEELECTOR Program. No longer need your stockroom be cluttered with small stocks of scores of grades. No longer need you find yourself holding grades that require different processing, yet give the same results. And you never need to worry about running short. Allegheny Ludlum STEELECTOR grades are always in stock.

STEELECTOR Program Ends Supply Problems

Huge warehouse stocks back up Allegheny Ludlum's STEELECTOR Program. You know before you order that the grade you have selected is in stock, in the size you choose. Here's how the STEELECTOR System works:

First, you select the right tool steel for your job by using a STEELECTOR Card. Then you check the STEELECTOR Data Stock List for the particular grade selected best for your job. (There is a List for each of the 18 STEELECTOR grades.) All sizes and shapes in stock are listed along with hardening, tempering, and annealing temperatures. The List also gives the typical analysis of the steel, its AISI number, and describes its properties. Typical applications are listed along with suggested working hardnesses to confirm your selection.



Free Booklet Explains the STEELECTOR System

You will find a complete description of the STEELECTOR Program in this colorful 10-page Allegheny Ludlum booklet. It tells how the STEELECTOR System helps you pick the right tool steels, save time, and end your supply worries.

Each of the STEELECTOR grades is listed in the booklet along with its description, applications, and AISI type number. Included are three handy STEELECTOR Cards that will save you time in picking the right steel for tool room, hot work, and high speed applications. Everyone who helps select tool steel needs this booklet. For your free copy ask your A-L representative, or write: Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh 22, Pennsylvania. Address Dept. TS12.

What Can The A-L STEELECTOR Program Do For You?

Whether you are president, purchasing agent, stock room supervisor, engineer, or heat treater, you will find the STEELECTOR System can save you time, reduce costs, and make your job easier. Check this list and see how the STEELECTOR System can help you:

Owner, president or vice president. Reduces costs in warehousing, purchasing, and inventorying. Insures selection of the right tool steel—prevents misapplication and wrong heat treatment.

Operating man, superintendent, foreman, production control man. Ends availability problems. Large local warehouse stocks enable your in-plant stocks to be reduced. Consistent high quality.

Engineer or metallurgist. Speeds selection of the right tool steel . . . saves the time formerly spent in selection for jobs that need it.

Specifier, designers, tool room man. Assures you of the availability of the size and grade you need. Only 18 grades to consider for 96 percent of all applications.

Stock room supervisor. Saves storage space because fewer grades need to be stocked. Ordering is simplified and paperwork reduced.

Heat treater. Helps you operate furnaces more profitably —more tools can be treated at a time.

Purchasing agent. Reduces paperwork and inventory needs.

To learn of all the benefits of the A-L STEELECTOR System, ask for the STEELECTOR booklet described in the adjoining column.

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0	1/8"	1/32"	1/16"	1¼"
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000	1/16"	.016"	.030"	7/8"

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tech digests

creases in staff were pressing problems to school boards and administrators alike. At the same time increasing costs of construction and operation along with teachers' salaries have made demands on taxpayers which call for more efficient utilization of all resources.

Work was started to develop and put to use electronic aids to teaching, particularly closed-circuit television, as a means of bringing the best available instruction to large numbers of pupils most economically. While still in the trial application stages, it seems that such new techniqaes offer promise for both reducing the cost and upgrading the quality of teaching.

Attention is also being given to installing better methods in custodial work, office routines, and cafeteria operation.

While it is not intended to discuss curricula in this portion of the report, it is worth mentioning that these, too, are being critically reviewed in many cases for their adequacy in meeting the needs of today's and tomorrow's complex industrial civilization.

From a paper "Practices in Operational Management—Local Government and Other Nonprofit Organizations" by George M. Goettelman, consultant, Philadelphia, Pa., presented at the Winter Annual Meeting of the American Society of Mechanical Engineers, 1960.

Design's Fourth Dimension

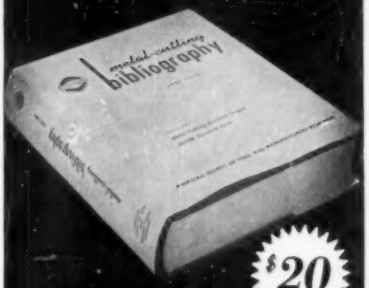
One of the early decisions the engineer often makes in design is the type and grade of material to be used, after which he refers to a set of standards covering that material and proceeds to work out the arrangement and proportion of the components based on the use of the selected material.

This procedure was adequate when the designer was limited to a small number of materials and design was essentially concerned with the geometry of the parts. Today, however, research has developed many types of engineering materials, each available in a wide variety of grades. The designer, therefore, must concern himself not only with part geometry, but also with that "fourth dimension," the selection of the most efficient and economical material to perform the required function.

Because geometrical considerations in design are closely related to materials and their properties, instead of making an early decision as to the type and grade of material, the designer should consider selection of material at the time that he makes decisions regarding part geometry.

From a paper "The Fourth Dimension in Design" by J. A. Gilligan, Structures Engineer, United States Steel Corp., presented at United States Steel Corp.'s Steel Design and Engineering Seminar.

this
BOOK



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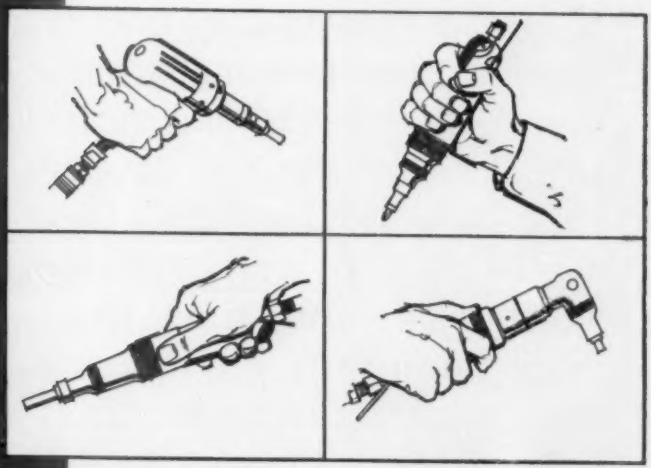

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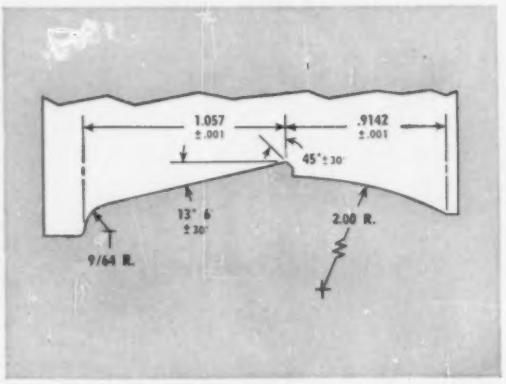
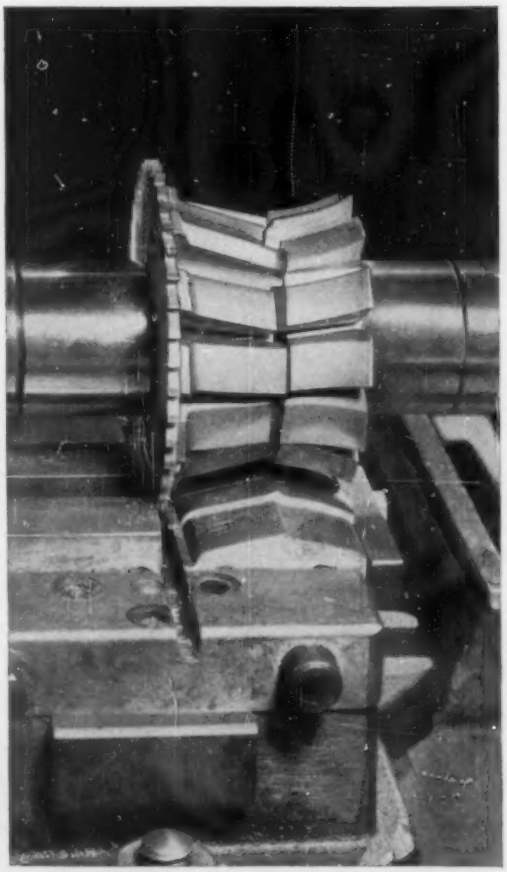
COMBINE



OPE

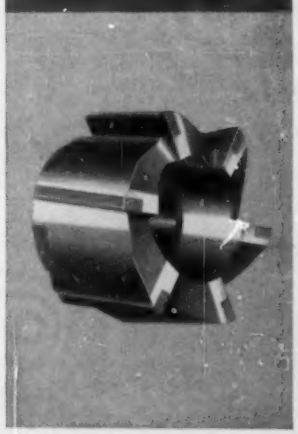
How many FREE OPERATIONS can you see in the set-up illustrated below ? Not a fair question, but there are TWO. With the help of Barber-Colman cutter engineering, the customer was able to combine complex and very accurate milling in a single, economical operation.* There may be possibilities for savings like this in your plant. Perhaps special form cutters can be designed for SINGLE-SETUP MACHINING of parts you may now be shaping, crush grinding, or milling. A Barber-Colman cutter engineer can help you develop these opportunities. He is a fully qualified tool designer. He won't waste your time. Even more important, engineering and manufacturing facilities backing him up cannot be duplicated anywhere. For example, an electronic computer is used to establish correct tool geometry. This means you get more actual development man-hours per job. The right combination



of flute helix, clearance angles, diameter, and number of teeth are determined scientifically—not by trial and error./The quality and depth of engineering talent available to you as a Barber-Colman customer can be worth many times the cost of tools. Early consultation on new parts can add to your engineering capacity. You get the benefit of proprietary innovations in metalcutting . . . in high-speed steel and carbide metallurgy, in tool design, and in manufacturing methods. Ask your Barber-Colman representative about this valuable free service.

RATIONS

*Two opposed surfaces on the part shown (left) require machining at right angles to the cutter axis. For efficient milling at those points, teeth must have both left-hand and right-hand axial relief. The problem was solved by making the tool interlocking, with axial relief in both directions. Opposed helical flutes assure smooth cutting and excellent surface finish. A free cutoff operation was gained by ganging a metal-slitting saw with the form cutters. Cutters are unground. Yet, all dimensions are held to a maximum tolerance of ± .002 in. Angular surfaces are held to ± 30 minutes.



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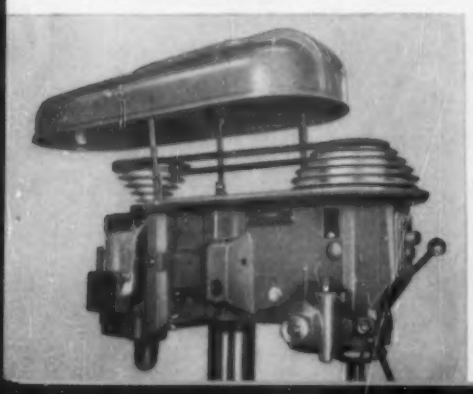
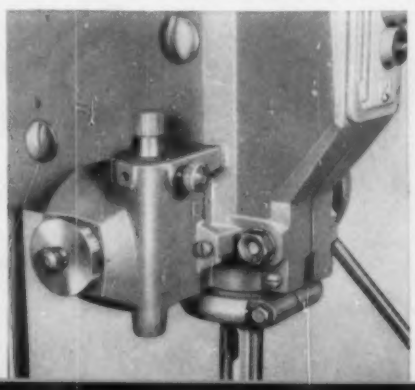
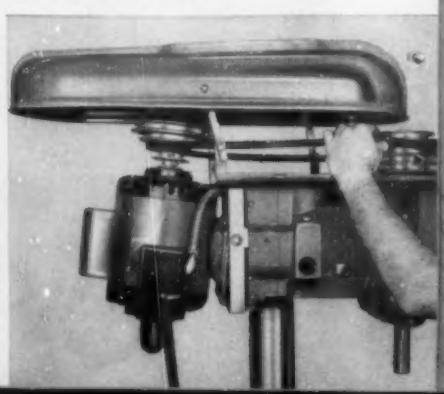
ALL NEW Interference-free Guard—Tilts up and back out of the way giving operator plenty of room to make belt and speed changes quickly, easily. Three specially designed supports and a stop hold steel guard in "up" position, built-in clips automatically lock guard in operating position when closed.



ALL NEW Internal Depth Stop Mechanism—A new concept in depth stops that eliminates bottom-of-stroke quill deflection which causes excessive drill breakage and downtime. Convenient adjustment knob permits fast, one hand operation, locks in position to stop pinion shaft at same depth through repeated cycles.



ALL NEW Pivot-type Motor Mount—Assures full release of belt tension before changing from one pulley speed to another, delivers longer belt life and eliminates possibility of damage to the belt. Maintenance of proper running tension on belt at all times prevents undue wear on bearings.



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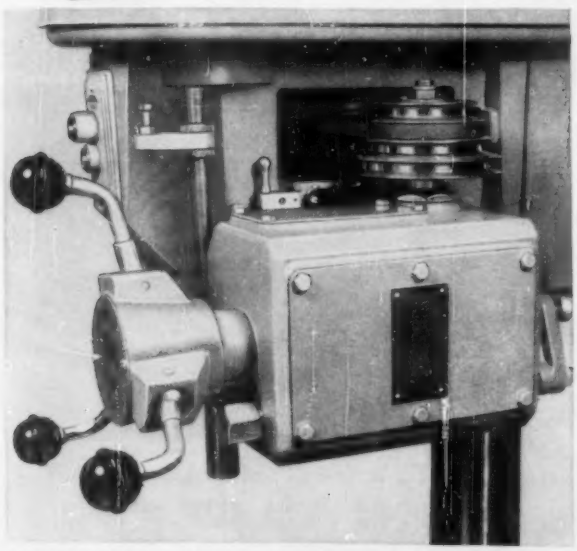
ALL NEW DELTA 17" DRILL PRESSES

Here is a major engineering advance from Delta to give you increased drilling accuracy, more job flexibility and greater operating economy. You can choose the machine best suited to your needs from 76 models in a complete line of 17" drill presses that incorporate the most up-to-date performance features available.

These drill presses are completely new—not merely improved or re-styled—but actually re-designed to deliver consistent precision operation under the most rugged work loads with little or no maintenance.

With the introduction of this all new 17" drill press line, Delta continues to provide the high quality of product that has made it the leading name in drill presses for over 31 years. Your Delta Industrial Distributor (listed under "TOOLS" or "MACHINERY" in the Yellow Pages) will gladly demonstrate how these 17's can save you dollars, hours and material. Why not call or see him soon!

FREE BROCHURE—Complete specifications and details on the full line of all new 17" drill presses and accessories. Simply write: Rockwell Manufacturing Company, Delta Power Tool Division, 620M N. Lexington Ave., Pittsburgh 8, Pennsylvania.



ALL NEW Rockwell Power Feed—Available as original equipment or as an accessory on every model, this advanced development in mechanical power feeds gives you: a front mounted pilot wheel for one hand operation and "flick of the wrist" control of feeding; infinitely adjustable drill point pressure and a built-in feature that permits remote control. For semi or fully automated operations, power feed can be electrically, hydraulically, pneumatically or mechanically interlocked with other machines.

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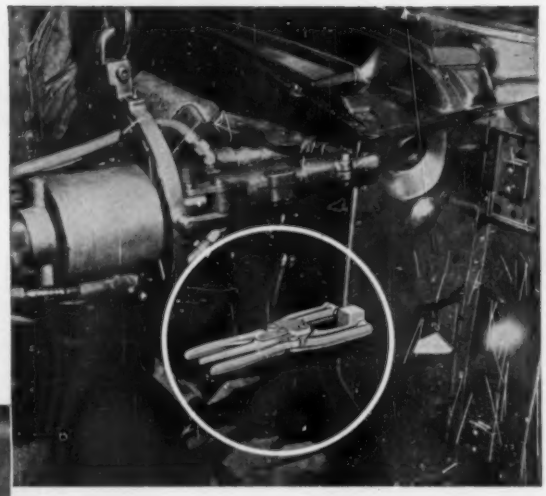
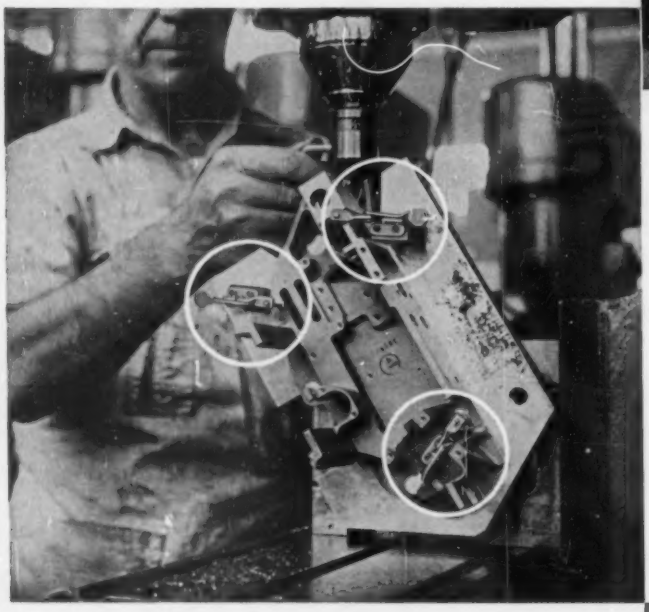
No. 2 of a series

Look what clamps are doing!

Practical uses of Wespo Toggle Clamps and Pliers that may suggest ways you can save

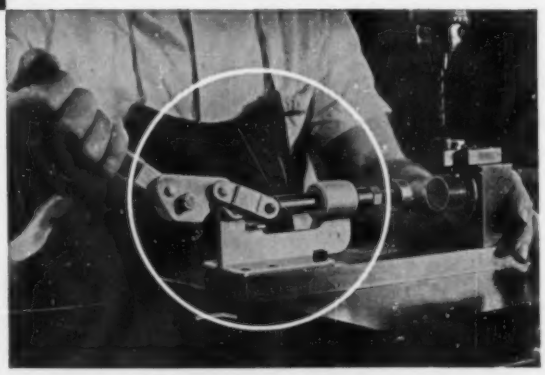




Low Cost Wespo Toggle Pliers have a myriad of uses in assembling operations—as portable clamps, clamping where space is limited, or overhead clamping. Their usefulness as portable clamps is demonstrated in this auto body welding operation. The plier shown has the Wespo "Quick-Trigger" release which permits one hand operation. All Wespo toggle pliers are engineered for fast, positive locking with a minimum amount of hand pressure. They are available in numerous styles and jaw sizes.

This Wespo Push-Pull Clamp serves as a simple fixture to hold a knurled ring securely during the drilling operation. The adjustable spindle is fitted with a large pad which mates with the inside diameter of the ring, holding it securely. Wespo makes a variety of push-pull clamps for use where smooth, horizontal clamping action is required. All models feature the "better 3-ways" Wespo design and are ruggedly built to stand hard use. Some models have locking action in both the "push" and "pull" positions.

Miniature Toggle Clamps, only 2½" overall!—These small, light weight Wespo Series 50 Clamps can do a hundred different jobs on small fixtures such as the one shown above. Their compact design and smooth operation also make them useful in the assembly of small parts, in electronic wiring and soldering operations, on fixtures where space is limited... anywhere a small, rugged clamp is needed. Maximum holding pressure is 35 lbs. Available with a horizontal or vertical mounting base; adjustable spindle.



NEW 16-PAGE WESPO CLAMP CATALOG!

More than 80 different models and sizes of clamps are described to help you quickly select the proper clamp for every clamping job.

Ask your Wespo Distributor for a free copy today.

WESPO

DIVISION OF VLIER ENGINEERING CORPORATION
A SUBSIDIARY OF BARRY WRIGHT CORPORATION BW
801 Burlington Avenue, Downers Grove (Chicago) Ill.
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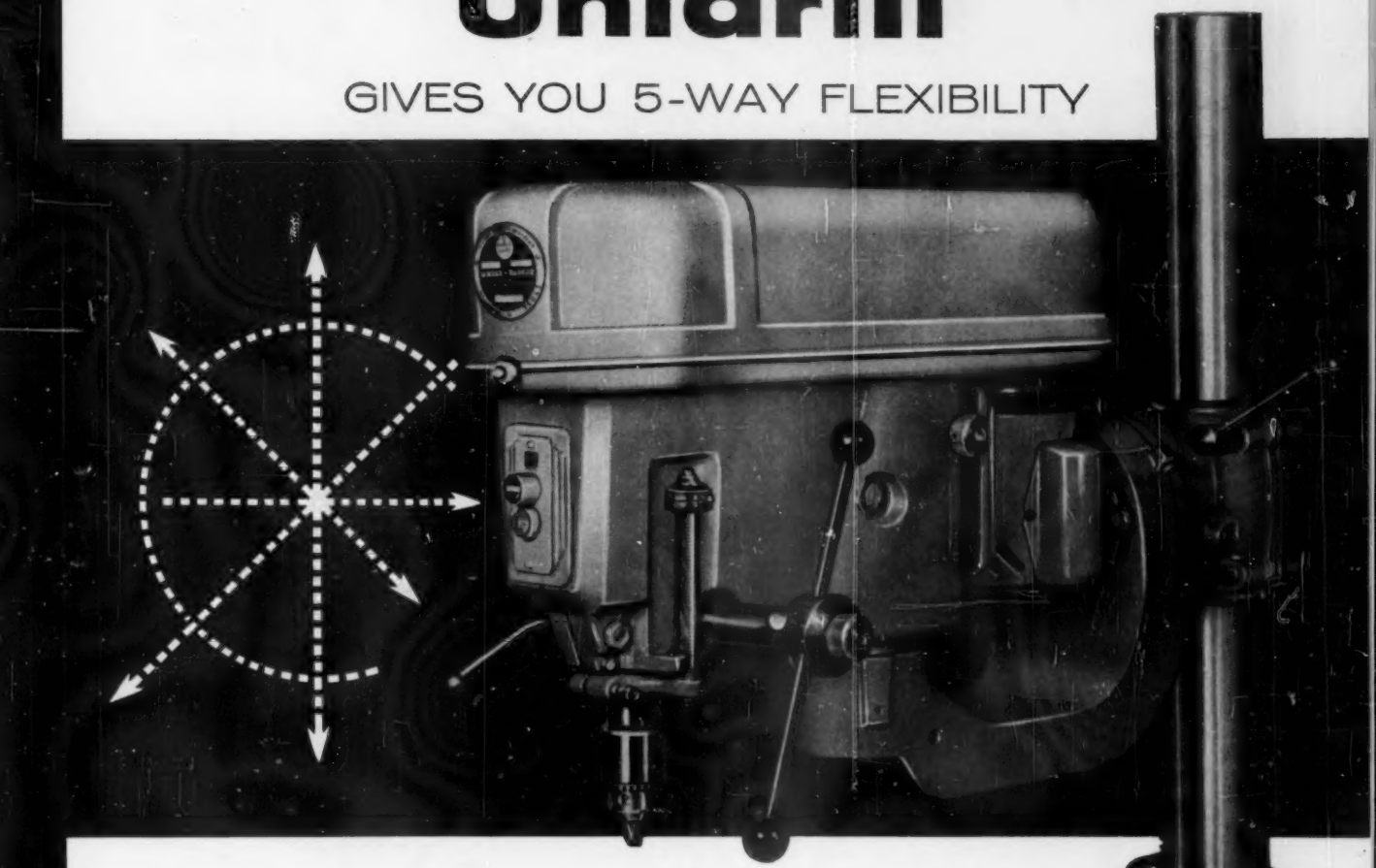
NEW Walker-Turner

Unidrill*

GIVES YOU 5-WAY FLEXIBILITY



With the Unidrill you can position the cutting tool to the work in five different ways—move and tilt the drill head to speed the operation, reduce set-up time and eliminate expensive jigs. It's a 2-foot arm radial drill press designed to handle problem drilling jobs—angular drilling, heavy work, bulky pieces requiring extra throat capacity or "reach" of the arm.

You can do reaming, spot facing, counterboring and many other jobs. The Unidrill offers six interchangeable spindles or spindle adapters plus a 12-speed multi-speed attachment that provide even greater versatility.

Ask your Walker-Turner Distributor (listed under MACHINE TOOLS or TOOLS in the Yellow Pages) to show you how the Unidrill can drill to the center of a 48" circle. With one demonstration of this flexibility in action, you'll learn why more people in metalworking call Walker-Turner the *value line*.

FREE BROCHURE shows the full Unidrill line available in floor and bench models with: Utility or Deluxe Head, High or Slo Speed, Key Chuck or Tapered Spindle. Write: Rockwell Manufacturing Company, Walker-Turner Division, Dept. WM-25, 400 N. Lexington Ave., Pittsburgh 8, Pa.

**Trademark*

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"LIGHT-HEAVYWEIGHT" MACHINE TOOLS
another fine product by
ROCKWELL

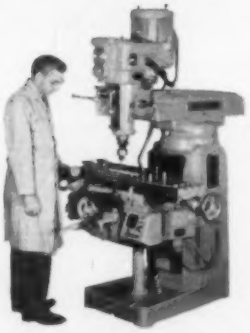
GREATEST SPEED RANGE

IN VERTICAL MILLING

65 to 4600 RPM

New GORTON VARIABLE SPEED HEAD Model 1-22 Mastermil

- The ideal head for milling high tensile strength alloys with maximum cutter efficiency.
- Remarkably smooth spindle operation throughout entire speed range from 65 to 4,600 RPM . . . insured by *unison-mechanical* change of pulley diameters, with positive control.
- Guaranteed high precision spindle of interchangeable self-contained design.
- Direct reading spindle speed dial provides fast speed selections.
- Maximum torque in low speeds through back gear design.
- Dial-type down feed—infinitely variable .250 to 4.000 inches per minute with built-in over-running clutch for feeding against positive stop.
- Traditional GORTON quality in every detail.



Write for Bulletin No. 2699 for complete description of new variable speed head and Gorton Mastermil.

A Gorton Product, the Finest of its Kind!

GORTON

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Milling, Die Sinking, Profiling and Engraving Machines with Manual Hydraulic, Electro-Hydraulic or Numerical Guidance Systems. Special Machines and Automated Transfer or Indexing Machines. Cutting Tools and accessories... Defense and special products.

BRINGS DOWN TOOLING COSTS

Only Allegheny Ludlum's Forging and Casting Division of all the companies in the U. S. supplies tool steel in cast-to-shape form, in forgings, and in composite die sections. Usually, of course, your design will strongly indicate which of these processes should be used. But when you have a case that is not clear-cut, you will especially appreciate the uniqueness of A-L's triple barrel service.

Because A-L's representatives are familiar with all three processes they give you an unbiased recommendation. Your A-L representative's only concern is for making your parts in the best and most economical manner. He's never under pressure to promote one process against another. You can put your trust in an A-L recommendation.

√ A-L's **Cast-To-Shape** tool steels are made of electric furnace steel melted to precise laboratory standards. Exacting foundry practice enables A-L to make castings—even very intricate shapes—so that little stock need be removed for finish. Why buy metal you don't use?

√ A-L's **Composite Die Sections** are made of fine A-L tool steel cutting edges electrically butt welded by a special process to nonhardenable mild steel bases. A wide range of straight and shaped sections is available in a huge array of sizes.

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For complete information on A-L's triple service ask your A-L representative for a copy of the 28-page booklet FC4, or write: ***Forging and Casting Division, Allegheny Ludlum Steel Corporation, Ferndale, Detroit 20, Michigan. Address Dept.*** *IE-12.*

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FORGING AND CASTING DIVISION

THE BEST THINGS IN TOOL LIFE ARE FREE

Utilization of machines, not conservation of cutting tools, is the way to find cost-free savings in the shop. Operating machines slowly to get long tool life is like "saving string." Speed determinations, based on total cost accounting (not machinability tables), go beyond smoke and blue chips to the unexplored opportunities in machine utilization. Real savings, today come from faster machine speeds and more efficient tool changing . . . to increase profit yield from a machine investment and boost productivity of people. They come big and easy from accurate presetting of tools and "packaged setup." To reduce downtime. To eliminate scrap . . . to shorten lead time and reduce parts inventories. Scully-Jones offers complete tooling **SYSTEMS** to help you develop these opportunities from existing capital and manpower. Tooling systems for transfer machines, multiple spindle automatics, single-spindle chuckers, radial drills, and others. Your Scully-Jones representative offers application ideas and complete information on quick-change, quick-set tooling. Phone him or write the factory.

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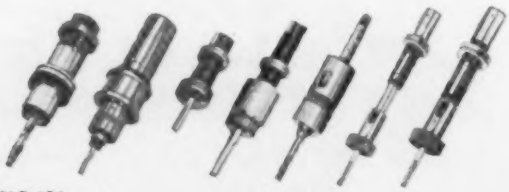
SCULLY JONES

QUICK-CHANGE
QUICK-SET TOOLING



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HERE'S A NEW CONCEPT IN HEAT TREATING TECHNIQUE.

AUTOMATIC 'PUNCH CARD' QUALITY CONTROL SYSTEM NOW PERFECTED.

ROBOTROL

"PUNCH CARD" SYSTEM WORKS LIKE THIS

With this system a standard punch card is the job ticket. The metallurgical department punches it to set up treatment factors for desired result. When the work arrives at the furnace the operator merely puts the card in the Robotrol panel. He can't treat the work without putting the card in. He can't put it in wrong. He doesn't have to read or set instruments, adjust dew points, time carburizing and diffusing periods, decide on type and timing of quench. The punch card controls these automatically. It can provide for a variety of operations and required cautionary procedures. As the work moves on and is completed the punch card provides a permanent record of the exact treatment given it.

Provides exact record of metallurgical treatment on every job

System completely eliminates factor of furnace operator error

LINDBERG ROBOTROL

Guarantees you precise uniformity and quality in heat treating

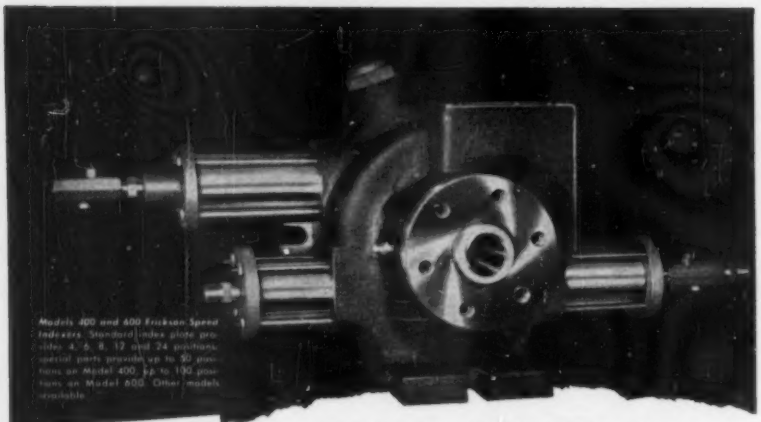
Introduced at the recent ASM Show at Detroit, this new Lindberg Robotrol automatic quality control system has been in development for more than five years. With this punch card system pyrometers, timers, atmosphere control instruments and all the factors on which metallurgical results are dependent are set up and automatically controlled. It is practically impossible for the furnace operator to treat the work improperly.

The punch card also provides an exact record of the treatment given each job. You know exactly what happened.

The Robotrol system is extremely flexible and can be adapted to any kind of heat treating cycle. For full information get in touch with your local Lindberg Field Representative (see your classified phone book) or write us direct.

LINDBERG ENGINEERING COMPANY
2447 West Hubbard Street, Chicago 12, Illinois

Los Angeles plant: 11937 S. Regentview Avenue, Downey, California. In Canada: Birlefco-Lindberg Ltd., 15 Pelham Ave., Toronto 9, Ont. Also, Lindberg plants in Argentina, Australia, England, France, Italy, Japan, Spain, Switzerland and West Germany.



Models 400 and 600 Erickson Speed Indexers. Standard index plate provides 4, 6, 8, 12 and 24 positions; special parts provide up to 50 positions on Model 400, up to 100 positions on Model 600. Other models available.

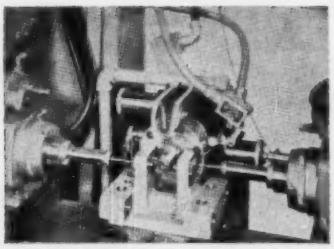
Angular accuracy within 2 minutes... repetitive accuracy in low "tenths" of a thousandth

ERICKSON INDEXERS–

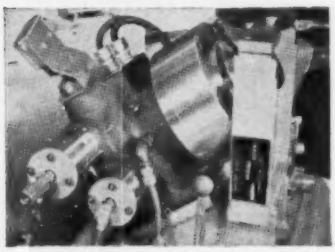
the economical way to smash automation bottlenecks

Even the most elaborate automatic production line can bog down *expensively* without rapid and accurate automatic parts positioning.

That's where Erickson Indexers really pay off. For you can interlock them into your production set-up with micro switches and solenoid valves. The hardened and ground lock pin operates in conjunction with the actuating mechanism to assure *positive positioning and angular accuracy within 2 minutes of a degree.* (Repetitive accuracy is no indication of angular accuracy. Erickson holds repetitive accuracy in low "tenths" of a thousandth.) And Erickson Indexers can maintain this great accuracy because their adjustable, self-contained shock control unit delivers a cushioned rotary load to the mechanism, thereby reducing wear.



Automatic drilling of cross holes being done on Erickson Model 400 Speed Indexer with air cylinder and Expanding Drawbar Mandrel. Indexer equipped with interlock limit switches.



Angular drilling in jet part held in air operated collet chuck on Erickson indexer operating automatically. Entire fixture designed and built by Erickson.

ERICKSON TOOL COMPANY

34352 SOLON ROAD • SOLON, OHIO

COLLET CHUCKS • EXPANDING MANDRELS • AIR-OPERATED CHUCKS • FLOATING HOLDERS • TAP CHUCKS • AUTOMATIC INDEXING • MASTER SPACERS • DIAPHRAGM CHUCKS • PUSH-ON ARBORS • QUICK-CHANGE HOLDERS • EXPANDING COLLETS • END-CLAMPING CHUCKS • AIR CYLINDERS (allowing stock to pass through) • EXPANDING JAW MANDRELS • SPECIAL HOLDING FIXTURES (including gear-holding) • BORING BARS • SPADE DRILLS • RECESSING TOOLS

Write for Catalog Section F today! You'll find many interesting applications for all Erickson holding tools. Take advantage of our free engineering service. An Erickson field engineer will gladly work with you for production economy.

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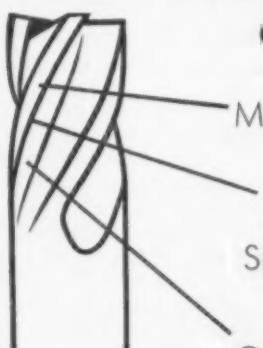
WHY QUALITY-CONSCIOUS MANUFACTURERS SPECIFY DIXIE SOLID-CARBIDE CUTTING TOOLS



MICRO SMOOTH BACK OFF

KEEN, RAZOR-SHARP CUTTING EDGE

GLASSY SMOOTH FACE

You get quality work with longer tool life, less deflection, less chatter and tearing, less breaking and chipping . . . when you use DIXIE SOLID-CARBIDE CUTTING TOOLS. Write for "complete-line" catalog.

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DIXIE TOOL INDUSTRIES, INC.

BRIDGEPORT 4, MICHIGAN • PLeasant 5-0545

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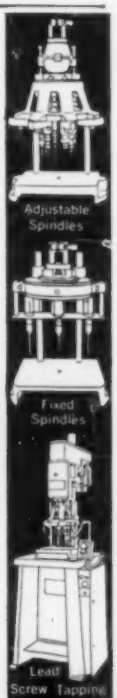
Complete Line-Ettco has the tool for your single or multiple small hole production job.



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MACHINE TOOLS

Price $10,336 — Model 2613-3 — Rent $66.21 per week

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23 types

BAND MACHINES

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12 types

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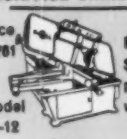

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CERTIFICATION OF DIAMOND CONCENTRATION ... your guarantee of full value ... and maximum productivity in every DoALL diamond wheel

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ELECTRONIC TUBE GENERATORS

Sizes: 1 Kw to 100 Kw output

STANDARD UNITS
Frequencies: 180 Kc to 600 Kc

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Frequencies: 3 Mc to 50 Mc

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Frequencies: 180 Kc to 600 Kc and 3 Mc to 50 Mc

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Sizes: 2 Kw to 30 Kw input
Frequencies: 400 Kc to 900 Kc

LEPEL LABORATORY SERVICE is offered without charge, to process your work samples and submit recommendations.

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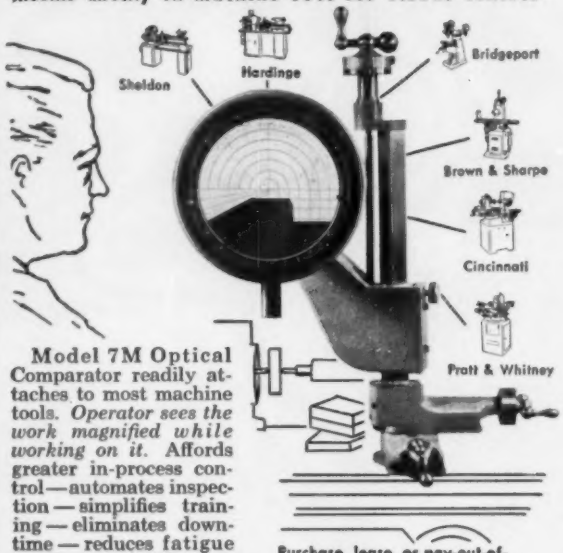
Optical Comparator

mounts directly on Machine Tool for Visual Control



Model 7M Optical Comparator readily attaches to most machine tools. *Operator sees the work magnified while working on it.* Affords greater in-process control—automates inspection—simplifies training—eliminates downtime—reduces fatigue—allows you to do work you otherwise might not be able to do.

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Write for catalog and additional information

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Kelvinator International reduces unit costs overseas with this 59-spindle Kingsbury

Seven horizontal, 11 vertical units work on compressor part

This center column machine performs a variety of operations. It has 11 different types of tools, including an end mill, hollow mills, combination tools, and a trepanning tool.

Each work fixture holds two parts. In the first pass around the machine it is on the right side of the fixture, and in the second pass on the left. Clamping is by a spring-loaded ram, unclamping by an air cylinder.

Most of our large center column machines operate on complex automotive parts. This one shows how well this type of machine succeeds in another field. We also design and build smaller machines for simpler jobs.

But simple or complex, each Kingsbury machine has good basic design and accurate rugged construction. We feel these are essential to high production with a minimum of rejects and downtime.

Before we ship any machine, we conduct a thorough capability study to make certain it will meet print specifications and will continue to meet them at the rate specified. Each unit is tested as if it were a separate machine. You don't have to live with a Kingsbury day after day to make it work.

For more information ask our representative to call. His name is in Thomas' Register and other directories. Kingsbury Machine Tool Corp. Keene N. H.

KINGSBURY

FIRST CHUCKING

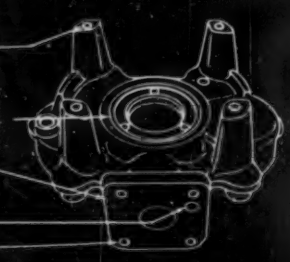
Vertical Units

DR – 9 HOLES, REAM – 2
C'SINK – 5, TAP – 4
CORE DRILL, TREPAN,
COMB. REAM, FACE, CHAM.
MILL FACE

Horizontal Units

DRILL – 2 STEPS
DRILL, C'SINK, TAP – 4

CAST IRON BLOCK FOR COMPRESSOR



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Vertical Units

HOLLOW MILL – 4 BOSSES
C'BORE – 3 HOLES
COMB. C'BORE & FACE – 2
DRILL, C'SINK, TAP – 2

Horizontal Units

DRILL, CORE DRILL,
BACK CHAMFER, REAM
DRILL – 2 STEPS

NOW NEW Slip Spindles ON ZAGAR HEADS for drilling, reaming, tapping

Spindle locations can be changed quickly, easily, on Zagar gearless heads. Rigidity is retained in a compact, low height head. Varying patterns can be economically machined with one head, adaptable to any standard drill press.

A minimum of spindle extension keeps head height down.

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Zagar INCORPORATED

USE MORE SPINDLES TO DO MORE WORK

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HARDENED and GROUND HSS BLANKS

Any decimal diameter —in any length. Mirror finish surface to gage tolerance. Many uses — —core pins, punches, gages, ejector pins, insert pins, special tools, etc. — Quick delivery.

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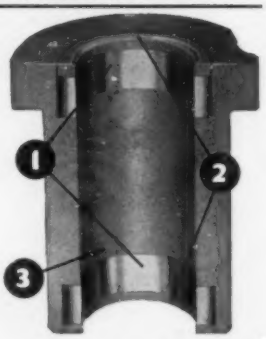
A Cost Saving

BUSHING STORY IN A NUT SHELL



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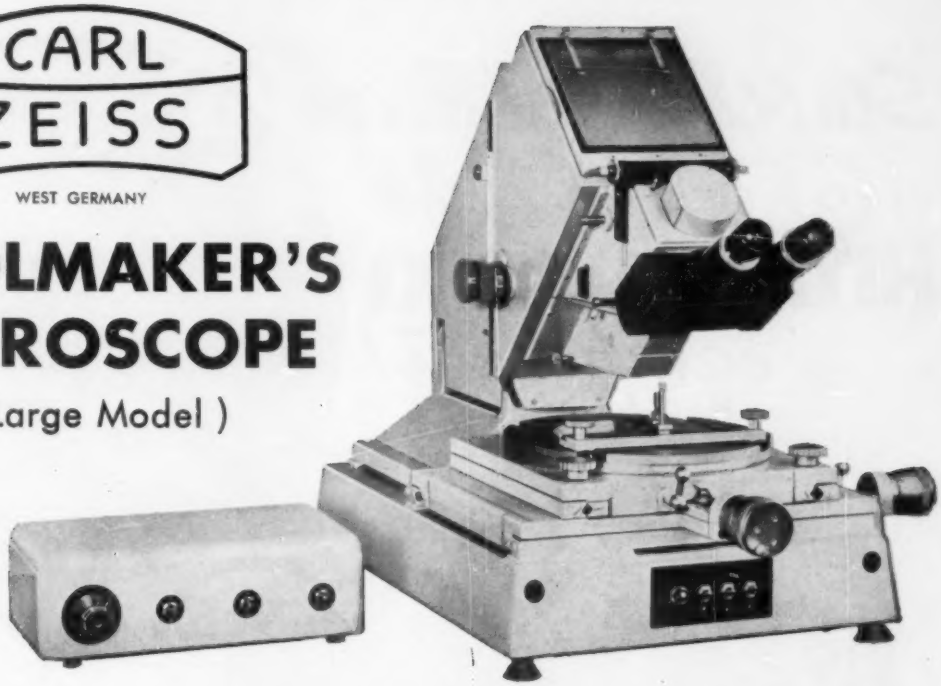
CARL ZEISS

WEST GERMANY

TOOLMAKER'S MICROSCOPE

(Large Model)



A decided advance over former instruments

Measuring range of 3x6″ permits extensive application

Small toolmaker's microscope also available.

This large toolmaker's microscope, made by Carl Zeiss, offers utmost ease, rapidity and great reliability of measurement.

Its new built-in gauge block displacement device makes it possible to quickly move the stage in the longitudinal direction in five steps, and in the transverse direction in two steps, thus eliminating the old fashioned method of interchanging gauge blocks. All manipulations, adjustments and readings are performed from the same position in front of the instrument.

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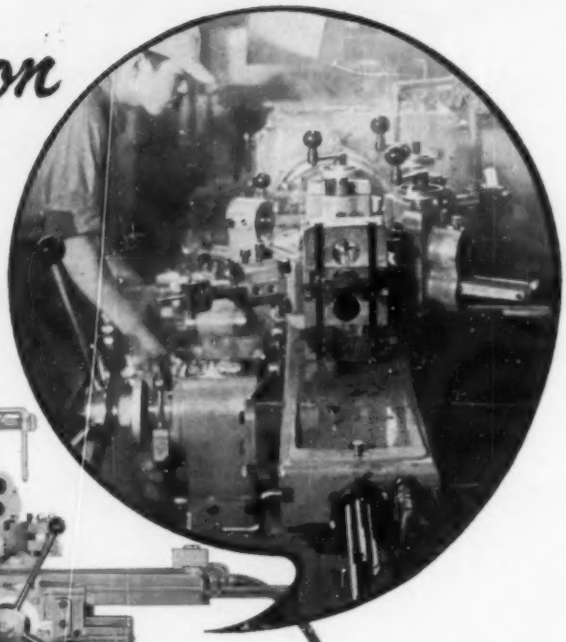

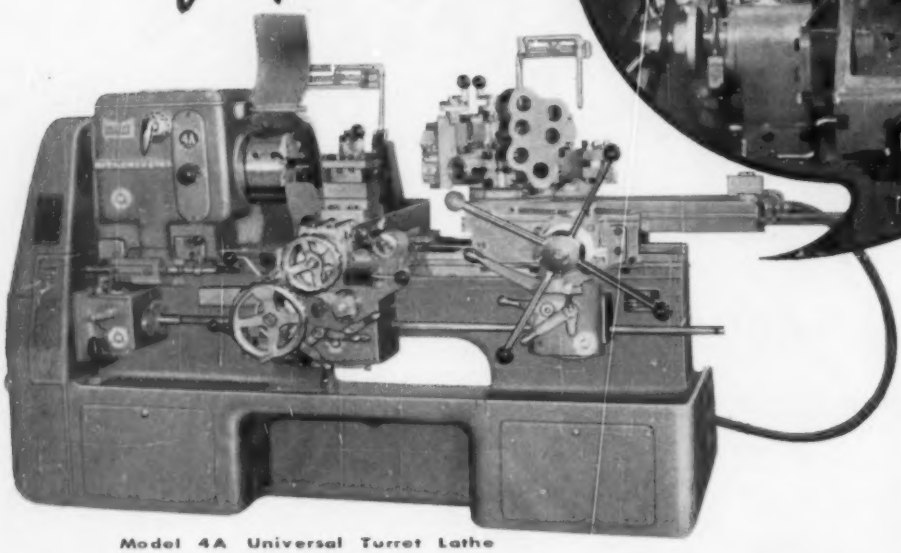

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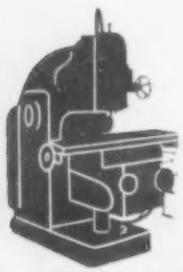
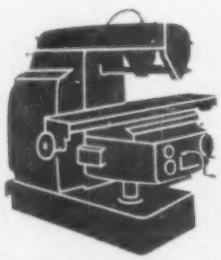
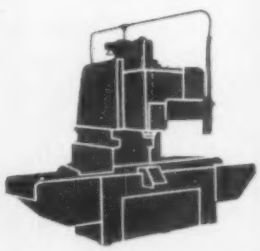


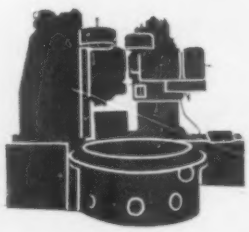
Medium Duty Milling Machine (Vertical Type)



Heavy Duty Milling Machine (Plain Type)



Production Milling Machine (Vertical Type)



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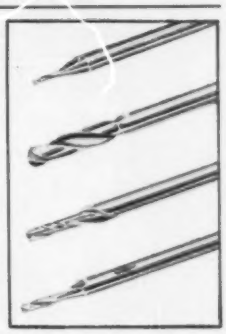

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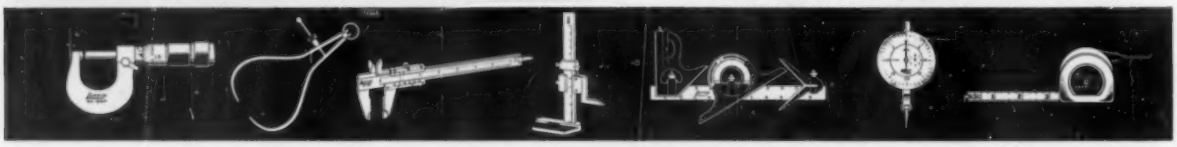

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If you're not using steel-rule dies and would like to learn more about them, we suggest that you attend ASTME's Creative Manufacturing Seminars on Prototype and Short-Run Tooling Methods.

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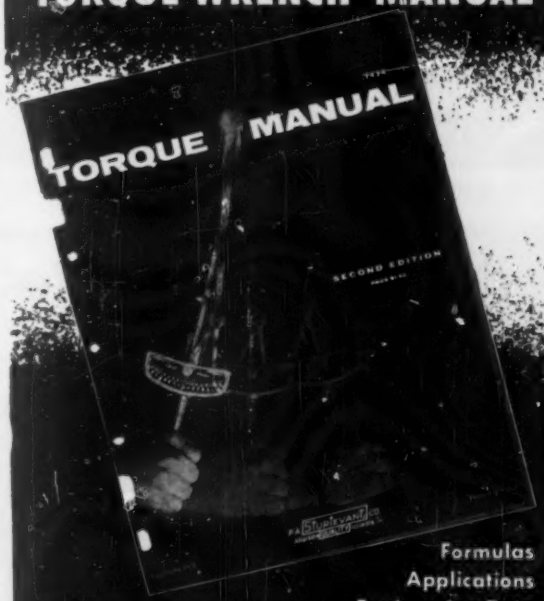

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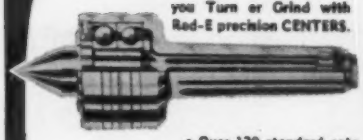

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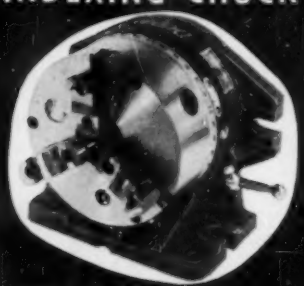

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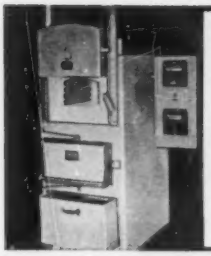

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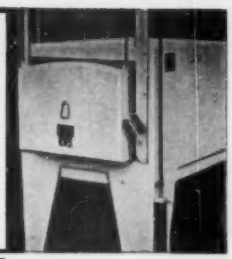

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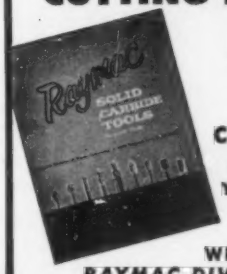

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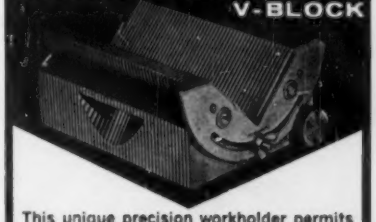

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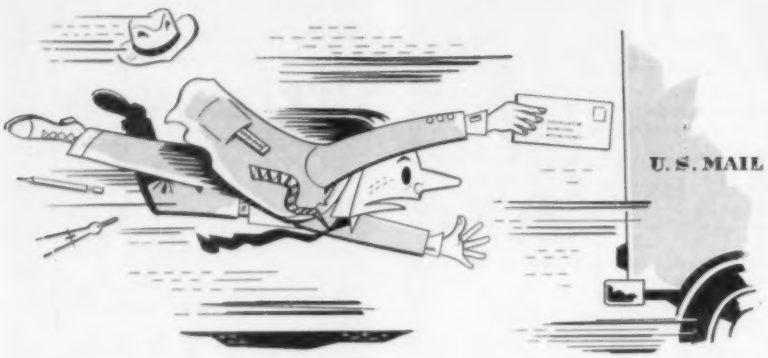

Time's Running Out! ! !
Enter Gadgets Contest Now

Why enter?

To have some of your pet ideas published in THE TOOL AND MANUFACTURING ENGINEER, receive a generous contribution for their publication and to win a prize.

What ideas?

Any and all ideas that show how you solved a production or toolroom problem. Send in as many as you like.

What prizes?

First prize, $100; two second prizes, $50 each; four third prizes, $25 each; and copies of either the *Tool Engineers Handbook* or *Die Design Handbook* to all close runners-up.

Do you mean I can win a prize and also get paid?

Certainly. We pay for all published Gadgets Contest entries—winners and nonwinners alike.

Who's eligible to enter the Contest?

ASTME members only.

Okay. What do I do to enter?

Submit a drawing (freehand sketches are acceptable) or photographs and a brief description, in your own words, of what your entry is, what it does and how it works. We'll take care of any redrawing or rewriting necessary.

Who picks the winners?

The ASTME Editorial Committee—Messrs. Jim Rodgers, Ray Knabe and John Kellogg.

Send in your entries before December 31. Mail them to:

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annual index 1961

technical articles

volumes 46 and 47

Subjects treated in the Technical and in the Tech Digests sections of THE TOOL AND MANUFACTURING ENGINEER during 1961 are listed in alphabetical order in this index. Also alphabetically listed are the authors of all articles, including Gadgets.

Realizing that the index is the key to the thirteen issues published in 1961—a key that unlocks a wealth of technical information—the editors have done everything possible to make it as reliable and as nearly complete as possible. We hope it is of assistance to you in the coming year.

THE tool AND manufacturing engineer

AMERICAN SOCIETY OF TOOL AND MANUFACTURING ENGINEERS
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1961 AUTHOR INDEX

—B—

Backer, W. R.—Balancing Grinding Wheels, Mar. 15, p. 51
Bagley, Fenton L., Jr.—Turning Hardened Tool Steels with Ceramic Tools, Jan. p. 99
Barnett, Orville T.—Maintenance Welding*, Apr. p. 170
Beecher, Bryce—A Patent Problem Deriving From Machine Maintenance*, Oct. p. 186
Behm, James N. and George C. Brown—Ultrasonics for Metalcutting, Mar. 15, p. 57
Bicking, Charles A.—Quality Standards in a Manufacturing Plant*, Mar. p. 158
Black, T. W.—Controlled Vibration—Key to Parts-Finishing Efficiency, Jan. p. 77
Dynamic Wheel Hardness Testing, Oct. p. 83
Manufacturing Planning—How the Experts Do It, Mar. 15, p. 39
Numerical Control's New Look, Sept. p. 89
Revolution in Manufacturing—Part 1, May p. 81
Revolution in Manufacturing—Part 2, June p. 83
Training Manufacturing Engineers—In-Plant Program Pays Off, Nov. p. 81
Bobbitt, Luther H.—Adjustable Pins Aid Draw Operations*, May p. 89
Bossmann, Cliff—Relieved Punch Sets Die Radius*, Jan. p. 73
Bott, Joseph C.—Machining Shafts Straight, May p. 111
Bowerbank, J., E. Holland, O. Mohl, J. Bryan—How To Improve Tracer Lathe Accuracy—Part 1, Apr. p. 64.
How To Improve Tracer Lathe Accuracy—Part 2, May p. 93
How To Improve Tracer Lathe Accuracy—Part 3, June p. 87
Bradford, J. T. and R. W. Kirkland—Computer Controlled Annealing*, Apr. p. 169
Bradshaw, F. F.—Industrial Management Education*, Mar. p. 160
Brandi, Rico R.—Improving Diamond Wheel Performance in Electrolytic Machining, Jan. p. 80
Breen, John M.—Adjustable Arm Increases Shear Efficiency*, Mar. 15, p. 46
Adjustable Cam Simplifies Machine Setup*, Oct. p. 81
Notched Grooving Tool Eliminates Chatter*, Feb. p. 77
Plastic Gage Speeds Inspection*, July p. 50
Shim Design Cuts Diemaking Time*, Apr. p. 61
Template Setup for Bored Holes*, May p. 87
Brown, Duncan J.—Gun Drilling—Universal Machine for Short Runs, July p. 51
Brown, George C. and James N. Behm—Ultrasonics for Metalcutting, Mar. 15, p. 57
Bruno, Donald A.—Cam Actuates Indexing Device*, Mar. 15, p. 46
Locking Device Holds Slip Bushings*, June p. 64
Modified Chuck Provides Repetitive Accuracy, Oct. p. 80
Sealing Device*, Mar. p. 70
Spring Plunger Strips Pilot*, Feb. p. 76
Bryan, J., J. Bowerbank, E. Holland, O. Mohl—How To Improve Tracer Lathe Accuracy Part 1, Apr. p. 64
How To Improve Tracer Lathe Accuracy—Part 2, May p. 93
How To Improve Tracer Lathe Accuracy—Part 3, June p. 87
Busch, T. N.—Calibrate Surface Plates the Easy Way, Nov. p. 92
Bush, Vannevar—The True Meaning of Professionalism*, Mar. p. 161

—C—

Cairns, G. A.—Metal Cleaning, June p. 164
Carlson, Norman E.—Air Pressure Aids Assembly*, Aug. p. 46
Carlson, W. M.—Program Exchange in Professional Societies*, Apr. p. 167
Carlyon, George C.—Machining Plastics, June p. 99
Christen, Carl—High-Production Gun Drilling, Feb. p. 83
Coch, Michael B.—Collet Device Holds Fixture*, May p. 86
Comstock, Lester—Roll Machines Stiffening Beads*, Mar. p. 69
Conn, Harry—Production Drilling for Short-Run Lots, Aug. p. 47
Cutroll, M. T.—Scale Models*, Apr. p. 171

—D—

Dahl, Hjalmar—Cam Handle Tightens Parts in Milling Fixture*, Mar. p. 70
Die Curls and Bends*, Feb. p. 78
Forming Operation Effects Metal Removal*, Jan. p. 76
Sliding Base Speeds Fixture Unloading, July p. 48
Steel Balls Increase Indexing Speed*, Nov. p. 88
Dallas, Daniel B.—Engineered Production of Carbide Dies, Oct. p. 107
Principles of Cold Forming—Part 1, Nov. p. 101
Principles of Cold Forming—Part 2, Dec. p. 72
Daniels, Robert—Sine Plate Grinds Compound Angles*, Dec. p. 58
De Michele, O. Mark—Wet-Belt Grinding Combines Accuracy, Speed, Feb. p. 111
Diehl, V. E.—Tooling With Granite, Oct. p. 87
Doshay, I.—Reliability Implementation in Engineering Design*, Feb. p. 205
Drought, A. B.—The Role of Science in American Manufacturing Progress, Apr. p. 57
Dutt, Donald and Howard Mather—Curing Under Pressure Improves Plastic Tooling, May p. 121

—E—

Exely, W. M.—Hydraulic Clamping Cuts Overall Machining Time, Feb. p. 79

—F—

Faulks, Thomas A.—Roller Attachment Elevates Carbide Tools*, Nov. p. 87
Fenton, Charles A.—Case Studies in Preventive Maintenance*, Apr. p. 170
Flynn, P., B. Sternlight and P. Lewis—Lubricating Rolling Contacts, May p. 256
Ford, R. W.—Points To Consider in Choosing Machine Tools for Production Requirements*, Nov. p. 191
Forward, Daniel J.—Inexpensive Fixture Solves Tooling Problem, July p. 49
Fuller, R. C. and K. L. Shaw—Faster Hot Forming with Low-Voltage Heating, Feb. p. 94

—G—

Gerber, H. J.—Altered Pipe Center Supports Large Parts*, Aug. p. 45
Cross Hole Drilling*, Jan. p. 75
Fixture for Stamping Circular Parts*, Mar. 15, p. 45
Improvised "No" and "No-Go" Gage*, May p. 88
Lathe Operates Tumbling Device*, Apr. p. 62
Vise Fixture Simplifies T-Bolt Milling*, Feb. p. 77
Gibbons, C.—Miniature Differential Eliminates Backlash*, June p. 66
Modified Chuck Provides Repetitive Accuracy*, Oct. p. 80
Precision Boring Head Made From Standard Chuck*, Aug. p. 46
Steadyrest Supports Multisided Work*, Nov. p. 86
V-Block Makes Through-Machining Possible*, Jan. p. 75
Giordano, Felix—What You Should Know About Chemical Coolants, Dec. p. 82
Glaser, Ralph L.—Single-Point Thread Cutting Goes Automatic, Sept. p. 105
Goodwin, Charles H.—How To Schedule Tool Programs with Magnets, Aug. p. 70
Greenewalt, Crawford H.—Creativity in The Organization, June p. 167
Guglielmi, A. C.—Radial Piercing Punch Eliminates Hole Distortion*, Dec. p. 58

—H—

Hackman, R. L.—Putting Plasma Jets to Work, Mar. p. 85
Hall, D. W., R. L. Van Alsten and M. Humenik—Metal Bonded Graphite, Feb. p. 203
Halliday, W. M.—Gaging Conical Holes*, Apr. p. 63
Hershkowitz, B. H.—Future Reliability Concepts and Ramifications*, Oct. p. 183
Heslen, Robert—Plant Digs In, Apr. p. 79
Storing and Retrieving Stock—Mechanized System Fetches and Carries, Mar. p. 75
Tracer Machine Contours to Millionths, May p. 101
Highsaw, Benjamin C.—Epoxy Indicator Holder for Magnetic Chuck Inspection*, Mar. p. 68
Hochschild, R. G.—Shrinkage in Plastic Molding, June p. 169
Hockett, Jack M.—Putting Magnesium Tooling to Work, July p. 53
Holland, E., O. Mohl, J. Bryan, J. Bowerbank—How To Improve Tracer Lathe Accuracy—Part 1, Apr. p. 64
How to Improve Tracer Lathe Accuracy—Part 2, May p. 93
How to Improve Tracer Lathe Accuracy—Part 3, June p. 87
Hug, G., A. O. Schmidt and J. R. Roubik—Effects of Workpiece Diameter on Tool Life, Apr. p. 69
Measuring Forces in Milling, Mar. p. 71
Hulley, O. S.—The Essential Triangle—Scientist, Engineer, Engineering Technician, Mar. p. 63
Humenik, M., D. W. Hall and R. L. Van Alsten—Metal Bonded Graphite, Feb. p. 203

—I—

Incardona, A. and H. H. Poett—Turning with Throwaway Inserts, Mar. p. 99
Standard Dimensioning for Jig Bore Drawings—Nov. p. 113
Irvine, James and Joseph Silvagi—Checking the Stress Patterns of Rotating Gears, Aug. p. 67
Irving, O. William—Controlling Costs with Statistics Aug. p. 41
Isetts, Roger—Fixture Centers Steel Ball for Drilling, Nov. p. 86
Fixture Machines Radial Grooves*, June p. 64
Indicator Assembly Checks Taper*, May p. 87
Lathe Stop Holds Precision Depths*, Mar. p. 68
Work Supporter Speeds Machine Loading*, Apr. p. 61

—J—

James, Robert D.—Adjustable Dowel Pin for Quick Fixture Location*, Jan. p. 74
Jeans, R. L.—How Westinghouse Activities in Foreign Trade Help American Industry*, Nov. p. 191
Johnson, R.—Expanding Mandrel Aligns Holes*, Mar. 15, p. 44
Jones, Ernest—Fixture Puts Collet Off-Center, July p. 49
Lathe Tool Cuts and Deburrs*, June p. 65
Jordan, Robert D.—Electrical Drives for Power Press Applications*, Oct. p. 183

—K—

Karvonen, L. and D. Kececioglu—Constructing Nomograms, Feb. p. 115
Kasper, Louis—Gage Inspects Large Diameters, Oct. p. 82
Kececioglu, D. and L. Karvonen—Constructing Nomograms, Feb. p. 115
Kincheloe, W. L., L. Zernow and I. Lieberman—Explosive Welding and Joining, July p. 75
Kirkland, R. W. and J. T. Bradford—Computer Controlled Annealing*, Apr. p. 169

*Brief article less than 1 page.

Kocher, H. F.—Semiautomatic Welding Simplifies Fixturing, Oct. p. 97
Kronenberg, Max—Exploring Metalcutting Phenomena with Dimensional Analysis, May p. 90
Kuhnel, A. H.—Computers for Manufacturing, June p. 95

—L—

Langlois, A. P.—Electromagnetic Metal Forming, May p. 105
Lewis, P., B. Sternlight and P. Flynn—Lubricating Rolling Contacts, May p. 256
Lieberman, I., W. L. Kincheloe and L. Zernow—Explosive Welding and Joining, July p. 75
Lieberman, I. and G. C. Throner—Stampings for the Space Age—by Explosive Forming, May p. 123
Linholm, A. A., A. R. Roy and R. Weavind—A Comparative Method of Evaluating the Strength of Diamond Grits*, Oct. p. 187
Loftus, M. W.—Bolster Adapter Supports Small Dies*, May p. 88
Cam-Actuated Cutter for Recessing*, Feb. p. 78
Development of Right Regular Cone Blanks, Nov. p. 117
Improvised Hole Spacer*, Apr. p. 62
Keys Swaged in Arbor Press*, Dec. p. 60
Workpiece Support Speeds Chucking on Small Areas*, Jan. p. 76
Long, Roger A.—Inorganic Bonding*, Feb. p. 207

—M—

Mallee, Francis M.—Plastics Cold Formed in Metal working Presses, Nov. p. 116
Marden, A. N.—Flexible Fixturing Device*, Apr. p. 63
Mariner, W. J.—Optical Tooling Solves Alignment Problem, Aug. p. 51
Mase, Richard—Precision Hole Boring with Portable Tools, Oct. p. 105
Mather, Howard and Donald Dutt—Curing Under Pressure Improves Plastic Tooling, May p. 121
Matthews, Norman A.—Applying Diamond Coatings*, Sept. p. 185
Meyers, Sheldon and William Thomas—Drilling Laminated Plastics Without Tearing, May p. 103
Miller, John M.—Reduced Costs Sighted through Optical Tooling, Feb. p. 103
Miller, R. W.—High-Speed Small-Hole Drilling, Dec. p. 85
Millholland, E.—Chuck Jaws Are Activated by Centrifugal Force*, Jan. p. 74
Mohl, O., J. Bryan, J. Bowerbank, E. Holland—How to Improve Tracer Lathe Accuracy—Part 1, Apr. p. 64
How to Improve Tracer Lathe Accuracy—Part 2, May p. 93
How to Improve Tracer Lathe Accuracy—Part 3, June p. 87
Morral, F. R. and C. T. Olofson—Machining Cobalt Superalloys, Oct. p. 111
Moser, Elliot—Steady Rest for Small Diameter Rods*, Mar. 15, p. 45
Murphy, F. B.—Chamfering Device Speeds Tapping Operations*, Mar. 15, p. 44
Flycutter Uses Throwaway Inserts*, Apr. p. 62

—Mac—

Macdonald, Ian and Lon Stringer—Static Converter Drives*, Nov. p. 193

—Mc—

McCombie, J. E.—Computer Plans Production Lines, Feb. p. 71
How Computers Solve Planning Problems, Dec. p. 55
McGinnis, Frank—Standardization Improves Reliability*, Mar. p. 157
McKee, Robert E.—Controls Speed Turning, June p. 78
McLaughlin, Clint—Collar Eliminates Backlash Error*, Nov. p. 87
Pin Gage Checks Depths to Within 0.002 Inch*, May p. 86
Sliding Tray Removes Stamped Parts, Mar. p. 67
Threaded Piercing Punches Cut Tooling Costs*, Dec. p. 60
Workpiece Support Improves Cutoff Operations*, Apr. p. 61

—N—

Nance, James J.—Changes Facing Management*, Apr. p. 168
Nelles, Maurice—Getting Results from Company Research Programs, Oct. p. 75
Neudorfer, D. H.—Conveyor Speeds Job Shop Brazing, Dec. p. 61
Neuweiler, N. G.—Russian Automation—Where It Stands Today, Sept. p. 111

—O—

Olofson, C. T. and F. R. Morral—Machining Cobalt Superalloys, Oct. p. 111
Opel, Walter R.—Automated Accuracy Made Possible by Precision Fixtures, Jan. p. 96

—P—

Parks, Mercer H.—Creative Thinking*, Jan. p. 204
Partridge, F. M.—Clamping Thin Skins, May p. 109
Paules, C. E.—Managing Engineers, June p. 164
Pendleton, J. S., Jr.—How To Cut Tool and Die Costs—Part 4, Mar. p. 95
Pentland, William—Selecting Machinable Metals, Apr. p. 89
Perins, Henry—Special Fixture Simplifies Electric-Motor Repairs*, July p. 50
Special Dog for Turning Small Shoulders*, June p. 66
Phillips, Austin—Coining Increases Component Life, Apr. p. 87
Picot, John J.—Machine Speeds Assembly of Lamination Stacks*, Dec. p. 60
Pilts, Henry E.—Chucking Device Holds Nonmagnetic Parts*, Feb. p. 76
Fixture Simplifies Tool Bit Sharpening*, May p. 87
Hole-Piercing Fixture for Short-Run Production*, Jan. p. 73
Poett, H. H. and A. Incardona—Standard Dimensioning for Jig Bore Drawings, Nov. p. 113
Turning with Throwaway Inserts, Mar. p. 99
Power, James—Cylindrical Edge Finder*, Oct. p. 79

—Q—

Quinn, James D.—Equipment-Performance Analysis*, Mar. p. 160

—R—

Rand, H. J.—Inventions for Profit*, Jan. p. 202
Radl, R. M.—Plastics Tooling for the Job Shop, Jan. p. 91
Rathe, A. W.—Management Practice*, Mar. p. 159
Reynolds, Craig A., Jr.—Standards for Data Processing, May p. 253
Richter, Alfred—Special Angle Plate Speeds Jig Bonding*, June p. 65
Riel, Frank J.—Bonding Sandwiches, June p. 163
Rogers, Vance E.—The Economic Justification of Numerically Controlled Machine Tools*, Nov. p. 191
Rose, C. H.—Chemical Milling Today, Oct. p. 93
Roses, Aaron L.—Techniques of Ultrasonic Machining, Apr. p. 71
Ross, Douglas T.—Design and Use of APT Language, Jan. p. 197
Roth, Edward S.—Don't Reject Those Good Parts, Nov. p. 89
How To Use Positional Tolerances—Part 2, Jan. p. 83
How To Use Positional Tolerances—Part 3, Feb. p. 98
Roubik, J. R., G. Hug and A. O. Schmidt—Effects Of Workpiece Diameter on Tool Life, Apr. p. 69
Measuring Forces in Milling, Mar. p. 71
Roy, A. R., R. Weavind and A. A. Linholm—A Comparative Method of Evaluating the Strength of Diamond Grits*, Oct. p. 187

—S—

Sampson, R. N. and C. H. Vondracek—Fiber-Glass Compressor Housing*, Sept. p. 186
Schaefer, K. H.—Scientific Methods of Investigation*, Apr. p. 167
Schaub, Tom—High-Temperature Epoxy Molds and Dies, June p. 170
Schlesinger, K. L.—Special Nosepiece Positions Parts*, May p. 89
Schmid, C. E.—Insuring Cleanliness*, Apr. p. 171
Schmidt, A. O., J. R. Roubik and G. Hug—Effects of Workpiece Diameter on Tool Life, Apr. p. 69
Measuring Forces in Milling, Mar. p. 71
Schneider, P. V.—Producing Powder Metallurgy Parts, Apr. p. 81
Schubert, E. J., Dr.—Statistical Data Reduction*, Apr. p. 171
Schumbacker, Willard A.—Repair Welding*, Apr. p. 173
Schwartz, N.—O-Ring Knockout Strips Stampings*, May p. 86
Sciaky, A. and M. Sommeria—Analog Welding Control*, Feb. p. 206
Shaw, K. L. and R. C. Fuller—Faster Hot Forming—with Low-Voltage Heating, Feb. p. 94
Shelhum, Amos L.—Motorized Unit Slices Tubing, July p. 47
Parts Handler Simplifies Heat Treatment, Nov. p. 88
Sherwin, Frederick S.—Value Analysis*, Mar. p. 159
Shively, Allen O.—Special Gage Speeds Surface Plate Layout*, Dec. p. 58
Silvagi, Joseph and James Irvine—Checking the Stress Patterns of Rotating Gears, Aug. p. 67
Simon, R. W.—New Steels and Products for Advanced Engineering Design*, Oct. p. 185
Simon, William—Leaded and Nonleaded Steel Properties*, Jan. p. 203
Smith, Joseph B., Jr.—Engineering Registration—Are National Standards Needed? Sept. p. 81
Smith, Y. T.—Welding Doubles Crane Capacity*, Mar. p. 157
Soepnel, A. P. J.—Pneumatic Press Feeder Increases Die Reliability, Dec. p. 87
Somers, J. C.—Methods Engineering in Material Handling*, May p. 253
Somers, W. Karl—Industry Wants Trained Manufacturing Engineers, July p. 45
Sommeria, M. and A. Sciaky—Analog Welding Control*, Feb. p. 206
Stangeby, John—Polishing Carbide Dies with Diamond Belts, Feb. p. 85
Sternlight, B., P. Lewis and P. Flynn—Lubricating Rolling Contacts, May p. 256
Stewart, P. L.—Establishing Dimensions and Tolerances for Gaging, May p. 113
Strasser, Federico—Bushings Maintain Alignment in Assembled Parts*, June p. 66
Clamp Simplifies Scribing*, Sept. p. 86
Clamping Device Pulls Blind Dowels*, Sept. p. 84
Die Buttons Double as Drill Bushings*, Sept. p. 84
Die Produces Curved Tubing*, May p. 89
Plate Aligns Pinless Dies*, Apr. p. 63
Pocket-Size Center Finder*, Sept. p. 86
Spring Actuates Prick Punch*, Sept. p. 86
Tap Guide Insures Alignment*, Sept. p. 85
Vise Jaw Protects Finished Surfaces*, Sept. p. 85
Stringer, Lon and Ian Macdonald—Static Converter Drives*, Nov. p. 193
Sutton, W. H.—Broaching for Maximum Production at Minimum Cost, Mar. 15, p. 61
Swanson, E. W., Jr.—Flush Pin Gage For Inspecting Key Slots*, Dec. p. 59

—T—

Taeyaerts, Jan—How To Apply Diamond Cutting Tools, Mar. 15, p. 47
Tarasov, L. P.—Grinding Fluids: Part 1—What They Are, June p. 67
Grinding Fluids—Part 2 Grinding Action July p. 60
Grinding Fluids—Part 3 Their Selection and Use Aug. p. 57
Tech, Kurt O.—Solving Problems in Gear Design with Computers, Sept. p. 87
Thomas, William and Sheldon Meyers—Drilling Laminated Plastics Without Tearing, May p. 103
Throner, G. C. and I. Lieberman—Stampings for the Space Age—by Explosive Forming, May p. 123

—V—

Van Alsten, R. L., M. Humenik and D. W. Hall—Metal Bonded Graphite, Feb. p. 203
Vaughan, V. N., Jr.—Communications Between Machines*, Jan. p. 200
Vondracek, C. H. and R. N. Sampson—Fiber-Glass Compressor Housing*, Sept. p. 186

—W—

Weavind, R., A. A. Linholm and A. R. Roy—A Comparative Method of Evaluating the Strength of Diamond Grits*, Oct. p. 187
Weinwurm, E. H.—Operations Research*, Sept. p. 185
Wennberg, Jens L.—How To Get the Most Out of Metalcutting, Mar. p. 81
Whitney, Ralph—Rubber Locks Collet Stop*, Aug. p. 45
Wichert, Karl E.—Characteristics of Helical, Rotary, Positive Displacement Compressors*, Oct. p. 185
Williams, Roy A.—Scheduling Machines and Manpower—One Chart Gives Answers, June p. 61
Winter, Otto W.—Getting the Most Out of Shell Molding, Jan. p. 109
Wright, James O.—Product Planning and Engineering, June p. 168

—Y-Z—

Yasho, Sam J.—Converting a Drill Press for Small-Hole Drilling, Sept. p. 113
Zambrzycki, John—The Electrical Control Panel Enclosure Space Problem*, Oct. p. 184
Zaustin, Michael V.—Straightening of Steel and Aluminum, Mar. 15, p. 69
Zernow, L., I. Lieberman and W. L. Kincheloe—Explosive Welding and Joining, July p. 75

*Brief article less than 1 page.

1961 SUBJECT INDEX

—A—

Abrasive belt grinding*, Oct. p. 173
Abrasive slurry, Feb. p. 88
Abrasives, barrel finishing, Jan. p. 78
Abrasives, ultrasonic machining, Apr. p. 73
Accuracy, automated, Jan. p. 96
Accuracy, tracer lathe, Apr. p. 64
Active grinding oils, June p. 71
Adhesive bonding, inorganic*, Feb. p. 207
Adjustable cam*, Oct. p. 81
Alignment nomograms, Feb. p. 115
Alignment plate, dies*, Apr. p. 63
Alloys
  high-strength milling, May p. 127
  high-strength tapping, Jan. p. 117
Altered pipe center*, Aug. p. 45
Aluminum alloys, Oct. p. 94
  forming, Feb. p. 94
  straightening, Mar. 15, p. 73
  turning, Aug. p. 71
Aluminum
  casting, Jan. p. 94
  machining*, Dec. p. 81
  straightening of, Mar. 15, p. 69
Amine soaps, June p. 72
Analog computer, Jan. p. 103, June p. 97
Analog welding control*, Feb. p. 206
Analysis, equipment performance*, Mar. p. 160
Analysis, value*, Mar. p. 159
Angle plate, special*, June p. 65
Angular extrusion dies, Dec. p. 75
Annealing, computer controlled*, Apr. p. 169
Antennas, space*, June p. 98
APT, Sept. p. 91; Jan. p. 197
Argon, Mar. p. 86
Assembly, carbide dies, Oct. p. 110
Assembly fixture*, Aug. p. 46
Atomic Hydrogen, Jan. p. 72
Attritious wheel wear, June p. 68
Autocollimation, Feb. p. 104
Autocollimator, June p. 87
Automated forging, Aug. p. 56
Automated forging press, June p. 76
Automated production line, Dec. p. 68
Automatic operation
  diesinking, Sept. p. 99
  programming, Sept. p. 90
  thread cutting, Sept. p. 105
  tongs*, June p. 82
Automation, Jan. p. 96
  drilling operation, Feb. p. 113
  Russian, Sept. p. 111
Autopromt, Sept. p. 91

—B—

Backlash*, June p. 66
Backlash error*, Nov. p. 87
Backward extrusion, Dec. p. 74
Bacterial growth in grinding fluids, June p. 70; Aug. p. 57
Balancing grinding wheels, Mar. 15, p. 51
Balancing, production*, Sept. p. 182
Ball-drilling fixture*, Nov. p. 86
Barrel finishing, Jan. p. 77
Bearing alignment, by optical tooling, Feb. p. 103
Belt finishing, Feb. p. 85
Bending die*, Feb. p. 78
Bilateral tolerances, Jan. p. 83
Blanking die design*, Apr. p. 61
Blind-hole drilling, Feb. p. 83
Bolster plate adapter*, May p. 88
Boltmaking, Nov. p. 101
Bonding ceramic tips*, Apr. p. 153
Bonding sandwiches*, June p. 163
Boring
  fixture*, Nov. p. 97
  head, Aug. p. 66; Nov. p. 96
  head, precision*, Aug. p. 46
  head, [illegible]rated, Dec. p. 70
  machine for gearboxes, July p. 57
  operations*, Mar. p. 93; May p. 87
Brazing, job shop, Dec. p. 61
Bright dip machine, Dec. p. 62
Broach handling, Mar. 15, p. 63
Broaching, Mar. 15, p. 61
Broaching, workholding devices, Mar. 15, p. 61
Budgetary control systems, Aug. p. 41
Budgets, research, Oct. p. 78
Burnishing*, Oct. p. 171
Burnishing operations, Dec. p. 71
Bushings, alignment*, June p. 66
Bushings, locking device for*, June p. 64

—C—

Calibrating surface plates, Nov. p. 92
Cam
  adjustable*, Oct. p. 81
  control of machine, Sept. p. 104
  machining, May p. 118
  systems, automatic threading, Sept. p. 106
Camera design*, Aug. p. 63
Canning machinery, June p. 94
Carbide
  carbide tools, grinding*, Dec. p. 139
  dies, Feb. p. 85; Apr. p. 71; Oct. p. 107
  grinding, Oct. p. 109
  polishing, Feb. p. 85
  research, Oct. p. 110
  -tipped gun drill, Feb. p. 83
  tooling*, May p. 116
  tools, Jan. p. 106
  tools, elevating*, Nov. p. 87
  vs. diamond, Mar. 15, p. 48
Carbides, machining*, Nov. p. 191
Carbides, turning, Mar. p. 99
Carbon, tool steel, effect of, Mar. p. 96
Cast
  epoxy plastic tools, May p. 121
  potting material, Feb. p. 105
  -to-size steel molds, Jan. p. 94
Casting
  accuracy, shell-molding, Jan. p. 113
  green-sand, Jan. p. 110
  investment, lost-wax, Jan. p. 109
  precision, Jan. p. 109
  size, shell-molding, Jan. p. 112
Castings*, Feb. p. 84
Castings, chemical milling of, Oct. p. 95
Center finder*, Sept. p. 86
Ceramic
  and carbide tools*, Dec. p. 139
  tips, bonding*, Apr. p. 153
  tooling*, Mar. p. 74; Apr. p. 153
  tools, Jan. p. 99
  tools*, Jan. p. 193
  tools, turning, Apr. p. 69
Chamfering device*, Mar. 15, p. 44
Charts, scheduling, June p. 61
Chatter*, Feb. p. 77
Chemical coolants, Dec. p. 82
Chemical milling, Oct. p. 93
Chip settling, Aug. p. 59
Chipless Machining*, Sept. p. 181
Chromium, tool steel effect, Mar. p. 96
Chuck jaws*, Jan. p. 74
Chuck-to-part fit, tracer lathes, Apr. p. 68
Chucking device*, Feb. p. 76
Chucking force, dynamic*, Aug. p. 115
Circuit-breaker manufacture, Dec. p. 61
Clamping
  device*, Sept. p. 84; Sept. p. 86
  hydraulic, Feb. p. 79
  thin skins, May p. 109
Classes of fits, May p. 114
Cleaning, metal*, June p. 163
Clutch disks, machining*, Feb. p. 109
Clutches, electromagnetic*, Nov. p. 181
Cobalt superalloys, machining, Oct. p. 111
Coils, work, May p. 103
Coining, Apr. p. 87
Cold extrusion, titanium*, May p. 97
Cold former transfer mechanism, Nov. p. 104
Cold forming, Dec. p. 72
  plastics, Nov. p. 116
  principles of, Nov. p. 101
  serrations, Nov. p. 102
Cold headers, Dec. p. 72
Cold pressing, Mar. 15, p. 67
Collet
  fixture*, July p. 49
  stop*, Aug. p. 45
  tandem, May p. 112
Communications, Oct. p. 78
Communications between machines*, Jan. p. 200
Compaction, explosive, May p. 126
Component life, Apr. p. 87
Compound angles*, Dec. p. 58
Compound curves, inspection*, Mar. p. 92
Compounds, water-base, June p. 67
Compressor, helical rotary*, Oct. p. 185
Computer
  controlled annealing*, Apr. p. 169
  controls production line, Dec. p. 68
  general purpose, Dec. p. 69
  real time*, Feb. p. 82
  role of the, June p. 84
  simulation, Feb. p. 73
  solves design problems*, July p. 56
Computers, Feb. p. 71; *May p. 254
  digital, Dec. p. 55
  for manufacturing, June p. 95
  solving business situations*, Sept. p. 107
  use in gear design, Sept. p. 87
Cone blanks, development, Nov. p. 117
Conical holes, gaging*, Apr. p. 63
Constructing nomograms, Feb. p. 115
Continuous graphs in cost control, Aug. p. 43
Continuous-path controls, Oct. p. 101
Contour welder, Sept. p. 104
Control
  environmental, June p. 83
  limits, cost control, Aug. p. 43
  panel*, Oct. p. 184
  unit*, Jan. p. 89
Controlled vibration, Jan. p. 77
Controlling costs, Aug. p. 41
Controls, turning, June p. 78
Conversion, direct energy, Jan. p. 71
Conversion systems, Jan. p. 71
Convex surfaces, hobbing*, Apr. p. 153
Coolants, chemical, Dec. p. 82
Core shift, Jan. p. 113
Corrosion, prevention of in grinding, Aug. p. 58
Corrosion resistance tests*, Oct. p. 98
Cost
  control, Aug. p. 41
  control, fraction defective, Aug. p. 42
  savings, powder metallurgy, Apr. p. 81
Costs
  metal removal, Mar. p. 81
  nonproductive, Mar. p. 81
  productive, Mar. p. 81
  tool, Mar. p. 81
  tool and die, Mar. p. 95
Crank shaft alignment, Aug. p. 52
Creative thinking*, Jan. p. 204
Creativity*, June p. 167
Cross hole drilling*, Jan. p. 75
Curling die*, Feb. p. 78
Curve extrapolation, Feb. p. 118
Curve interpolation, Feb. p. 118
Curves, nomograms for, Feb. p. 116
Cutoff operations*, Apr. p. 61
  operations, cold forming, Nov. p. 105
Cutter
  breakage*, Jan. p. 89
  cam-actuated*, Feb. p. 78
  overloading*, Jan. p. 90
Cutting
  compounds, Oct. p. 106
  conditions, tapping, Jan. p. 118
  edge displacement, Mar. p. 72
  force deflection, Apr. p. 68
  force measurement*, Apr. p. 153
  force pulsations*, Mar. p. 147
Cutting, plasma-arc, Mar. p. 87
Cutting speeds
  determining, Mar. p. 84
  effects of, Mar. p. 82
Cutting tools, diamond, Mar. 15, p. 47
Cycle time, automatic threading, Sept. p. 107
Cylindrical grinding*, Jan. p. 90; Aug. p. 116

—D—

Damping grinding vibrations*, Aug. p. 117
Data processing, standards for*, May p. 253
Deburring operations, Jan. p. 77;* June p. 65
Deburring by ultrasonic machining, Mar. 15, p. 59
Deformation of press frames*, Aug. p. 115
Degassing unit, Aug. p. 54
Depth gage*, May p. 86
Depth hardening, Mar. p. 96
Design
  EDM., Feb. p. 89
  machine, June p. 85
  powder metallurgy, Apr. p. 82
  transfer machines, Jan. p. 96
Design's fourth dimension*, Dec. p. 155
Diameter gage*, Oct. p. 82
Diamond
  belts, Feb. p. 85
  characteristics of, Mar. 15, p. 47
  coatings*, Sept. p. 185
  cutting tools, Mar. 15, p. 47
  grits*, Oct. p. 187
  tool design, Mar. 15, p. 47
  tools, applications of, Mar. 15, p. 49
  wheels, Jan. p. 80
Die
  buttons*, Sept. p. 84
  casting, Jan. p. 109
  casting, aluminum alloys*, Feb. p. 84
  curling and bending*, Feb. p. 78
Die design, Dec. p. 58*
  carbide, Feb. p. 86

*Brief article less than 1 page.

Die design (Continued)
curve tubing*, May p. 89
engineering, Oct. p. 109
for cold forming, Dec. p. 72
forming*, Jan. p. 76
materials, powder metallurgy, Apr. p. 86
refinishing, Feb. p. 87
unloader*, Mar. p. 67
Dielectric solution, Feb. p. 88
Diemaking, EDM, Feb. p. 88
Dies
bending, Mar. p. 95
carbide, Feb. p. 85; carbide*, Dec. p. 140
carbide*, Dec. p. 140
cold-blanking, Mar. p. 95
cold extrusion, Mar. p. 95
draw and extrusion, Feb. p. 85
drawing, Mar. p. 95
extruding, Mar. p. 95
extrusion, Dec. p. 91
hobbing, Mar. p. 95
overloaded*, May p. 238
punching*, Apr. p. 153
Diesinking, automatic, Sept. p. 99
Differential, miniature*, June p. 66
Digital computer, June p. 97
Digital programming*, Jan. p. 194
Dimensional analysis, May p. 90
Dimensions, gaging, establishing, May p. 113
Dimensions, jig bore drawings, Nov. p. 113
Disk check, single, May p. 94
Disk check, twin, May p. 93
Dog, special*, June p. 66
Dowel pin*, Jan. p. 74
Dowel pin puller*, Sept. p. 84
Downtime, cost control, Aug. p. 42
Draft, shell-molding patterns, Jan. p. 114
Draw dies, carbide, Feb. p. 85
Drawing, three-dimensional, Jan. p. 102
Drill fixture*, July p. 49
Drill press conversion, Sept. p. 113
Drilling, Oct. p. 104; Nov. p. 108
cobalt superalloys, Oct. p. 111
cross-hole*, Jan. p. 75
fixture*, July p. 48
gun, Feb. p. 83; July p. 51
laminated plastics, May p. 103
machine, building-block, Oct. p. 92
machines, multiple spindle, Aug. p. 48
numerically controlled, Feb. p. 113; Dec. p. 85
operations, automation, Feb. p. 113
production, Aug. p. 47
radial holes*, Mar. p. 79
small hole, Sept. p. 113
turret, Feb. p. 113
Drives, power-press*, Oct. p. 183
Drives, static converter*, Nov. p. 193
Dynamic chucking force*, Aug. p. 115
Dynamic testing, Oct. p. 84
Dynamometer, Mar. p. 72
Dynamometer, Piezoelectric*, June p. 151

—E—

Eccentric turning*, Sept. p. 181
Economic growth, May p. 82
Edge finder, cylindrical*, Oct. p. 79
Education
engineering, May p. 83; Nov. p. 81
engineers, July p. 45
industrial management*, Mar. p. 160
Efficiency curves, milling machine, Mar. p. 74
Efficiency, milling machine, Mar. p. 74
Electric motor fixture*, July p. 50
Electrical discharge machine, Feb. p. 88
Electrical discharge machining*, Nov. p. 191
Electrochemical machining*, Nov. p. 191
Electrode erosion, Feb. p. 88
Electrolysis, Feb. p. 88
Electrolyte, Feb. p. 88
Electrolytic machining, Jan. p. 80; Feb. p. 88*; Sept. p. 181*
Electromagnetic clutches*, Nov. p. 181
Electromagnetic forming, applications, May p. 108
Electromagnetic metal forming, May p. 105
Electron beam machining*, Nov. p. 181
Electronic gaging*, Jan. p. 90
Energy control in electromagnetic forming, May p. 106
Energy conversion, Jan. p. 71
Engineering
curricula, Apr. p. 57
die, Oct. p. 109
education, May p. 83; July p. 45
function, Nov. p. 81
materials, new developments, Apr. p. 85
methods in material handling*, May p. 253
work, divisions of, Mar. p. 65
Engineers, managing*, June p. 164
Engineers, manufacturing, July p. 45
Environment and productivity*, May p. 239
Epoxy molds and dies, high-temperature*, June p. 170
Epoxy paint, protective, July p. 56
Equipment-performance analysis*, Mar. p. 160
Equipment selection, Mar. 15, p. 41
Error, tracer lathe, May p. 93
Evaluation of grinding fluids, Aug. p. 63

*Brief article less than 1 page.

Exotics, machining, Feb. p. 88
Expanding mandrel*, Mar. 15, p. 44
Explosive compaction, May p. 126
Explosive forging, May p. 126
Explosive forming, May p. 123; June p. 86
facilities, May p. 124
materials, May p. 124
vs. conventional drawing, May p. 123
Explosive truing, May p. 125
Extruded titanium fittings*, May p. 97
Extruding dies, Dec. p. 72
Extrusion dies, carbide, Feb. p. 85
Extrusion
die types, Dec. p. 91
dies, angular, Dec. p. 75
dies, materials, Dec. p. 91
dies, radial, Dec. p. 75
of steel, Dec. p. 91
metal, Nov. p. 103

—F—

Facing cobalt superalloys, Oct. p. 112
Factories, underground, Apr. p. 79
Fastening devices, Dec. p. 65
Fiber-glass compressor housing*, Sept. p. 186
Financing capital equipment*, Dec. p. 151
Fire hazards, in grinding oils, Aug. p. 58
Fixture
assembly*, Aug. p. 46
ball drilling*, Nov. p. 86
boring*, Nov. p. 97
clamping, Feb. p. 81
collet*, July p. 49
collet device*, May p. 86
drill*, July p. 49
drilling*, July p. 48
electric motor*, July p. 50
hole-piercing*, Jan. p. 73
indexing*, Nov. p. 88
induction, Jan. p. 88
part-piercing*, Dec. p. 60
positioning*, Jan. p. 74
special trunnion, Oct. p. 103
stamping*, Mar. 15, p. 45
toolbit sharpening*, May p. 87
Fixtures
aircraft, Oct. p. 105
pallet, Jan. p. 96
plastic, Jan. p. 93
precision, Jan. p. 96
welding, Oct. p. 97
Fixturing device, flexible*, Apr. p. 63
Flame hardening*, Oct. p. 171
Flooding, grinding fluids, Aug. p. 60
Fluids
classification of grinding, June p. 70
grinding, June p. 67; Aug. p. 57
grinding, evaluation of, Aug. p. 63
water-base, June p. 72
Flycutter*, Apr. p. 62
Forces, shearing*, Nov. p. 183
Forging, Mar. 15, p. 54
automated, Aug. p. 56
die, Jan. p. 104
explosive, May p. 126
precision, Jan. p. 109
press, automated, June p. 76
Forming
aluminum alloys, Feb. p. 94
die*, Jan. p. 76
hot, Feb. p. 94
metal, electromagnetic, May p. 105
operations*, Jan. p. 76
stainless steel, Feb. p. 94
stretch, Jan. p. 87
superalloys, Feb. p. 94
titanium alloys, Feb. p. 94
tool steels, Feb. p. 94
Forces in sheet metal punching*, Dec. p. 139
Forward extrusion, Dec. p. 74
Fraction defective, cost control, Aug. p. 42

—G—

Gage
dial indicators*, May p. 88
diameter*, Oct. p. 82
flush pin*, Dec. p. 59
locators, May p. 113
plastic*, July p. 50
surface plate*, Dec. p. 58
Gages
acceptance, Nov. p. 89
miniaturized thickness*, Jan. p. 116
part-measurement, tracer-lathe, Apr. p. 68
Gaging, (see also Inspection)
conical holes*, Apr. p. 63
electronic*, Jan. p. 90
interchangeability, Jan. p. 86
paper, Feb. p. 99
tolerances, Jan. p. 83
Gear
bibliography*, Nov. p. 181
correction*, Nov. p. 181
design, Sept. p. 87
honing*, Nov. p. 99
inspection system, July p. 58
machining*, Mar. p. 93; May p. 116
production, powder metallurgy, Apr. p. 81
shaving*, Jan. p. 90; June p. 151
shaving machine, Sept. p. 102
testing machine, Aug. p. 68
welding*, Mar. 15, p. 55
Gears, stress patterns, Aug. p. 67
Gel, thermosetting, Jan. p. 102
General-purpose computer, Sept. p. 88
Geometry, cutting tools, Apr. p. 90
Geometry, diamond tools, Mar. 15, p. 49
GEST, Feb. p. 74
Glazing, grinding wheels, June p. 68
Granite, tooling, Oct. p. 87
Granites, black, Oct. p. 89
Graphical analysis, gears, July p. 58
Graphite, machining*, May p. 237
Graphite, metal-bonded, Feb. p. 203
Graphs, scheduling, June p. 61
Green-sand casting, Jan. p. 110
Grinder, numerically controlled, Nov. p. 98
Grinding
automated cylindrical*, Aug. p. 116
carbide, Oct. p. 109
carbide dies*, Dec. p. 140
carbide tools*, Dec. p. 139
control, transistorized*, Sept. p. 183
electrolytic, Feb. p. 91
fluids, June p. 67; Aug. p. 57
fluids selection, Aug. p. 61
measurement during*, Nov. p. 181
oils, Aug. p. 61
operations, Jan. p. 107
punch*, Mar. p. 94
in Russia, Mar. p. 149
technology, Oct. p. 83
tool, vibratory*, Dec. p. 139
twist drill*, Sept. p. 183
vibrations, damping*, Aug. p. 117
water-base fluids, Aug. p. 62
wet-belt, Feb. p. 111
wheel wear*, Dec. p. 140
Grinding wheel
balancing, Mar. 15, p. 51, 53
effects of vibrations, Mar. 15, p. 52
selection, Oct. p. 84
testing*, June p. 151
unbalance*, Jan. p. 194
wear, Mar. 15, p. 51
Grooving tool, notched*, Feb. p. 77
Guard, vise jaw*, Sept. p. 85
Gumming in grinding wheels, June p. 69
Gun-drilling, Feb. p. 84; July p. 51
Gun drilling, high-production, Feb. p. 83

—H—

Handling, mechanized, Mar. p. 75
Hardened steels, machining*, Nov. p. 191
Hardening, depth, Mar. p. 96
Hardness defined, Oct. p. 83
Hardness testing, dynamic wheel, Oct. p. 83
Heating, cold, Nov. p. 101
Heart surgery*, May p. 115
Heat generation, grinding, June p. 69
Heat-resistant alloys, machining*, Nov. p. 191
Heat-treat distortion, elimination of, Nov. p. 100
Heat-treating, safety factors, Mar. p. 95
Heat-treatment, small parts*, Nov. p. 88
Heating, low-voltage, Feb. p. 94
High-strength alloys, milling, May p. 27
High-strength steels*, Dec. p. 152
Hobbing convex surfaces*, Apr. p. 153
Hobbing machines*, June p. 151
Hole boring, precision, Oct. p. 105
Hole-circle layout, Nov. p. 115
Hole distortion*, Dec. p. 58
Hole-finishing operations, Jan. p. 96
Hole-piercing fixture*, Jan. p. 73
Hole spacer, improvised*, Apr. p. 62
Hooke's Law, Mar. 15, p. 69
Hot forming, Feb. p. 94
Hydraulic clamping, Feb. p. 79
Hydraulic drives, symbols for*, Jan. p. 194
Hydraulic tracers*, Nov. p. 183
Hydrogen, Mar. p. 86
diatomic, Jan. p. 71
monatomic, Jan. p. 71
Hydrostatic drive*, Jan. p. 193

—I—

ICBM, operational readiness*, Apr. p. 70
Idea file, Mar. 15, p. 40
Inactive grinding oils, June p. 71
Index machine*, Oct. p. 91
Indexing
device*, Mar. 15, p. 46
fixture*, Nov. p. 88
machine*, Jan. p. 88; Mar. 15, p. 56; June p. 77
Indicator holder, epoxy*, Mar. p. 68
Indirect labor, cost control in, Aug. p. 42
Induction heating fixture, Jan. p. 88
Industrial growth, May p. 81
Industrial management education*, Mar. p. 160
Industrial Revolution, New, June p. 83
Industrial TV*, Sept. p. 88
Industrial waste, June p. 84
Insert tooling*, Dec. p. 81
Inspection (see also Gaging)
compound curves, Mar. p. 92
gage, plastic, July p. 50
labor, cost control, Aug. p. 42
of large parts, Aug. p. 51
numerically controlled, Sept. p. 96
radiographic, Nov. p. 110
systems, Mar. 15, p. 42
tapers*, May p. 87
tolerances, Feb. p. 98
Instrumentation, June p. 84
Interchangeability, gaging, Jan. p. 86
Interference fits, May p. 113
Internal deburring, Jan. p. 79

1961 subject index

Inventions for profit*, Jan. p. 202
Inventories, in-process, Feb. p. 74
Inventory, control, Mar. p. 75
Investigation, scientific methods*, Apr. p. 167
Investment casting, Jan. p. 109

—J—

Japanese numerical control, Oct. p. 99
Jig bore drawings, dimensioning, Nov. p. 113
Jig boring*, June p. 65
Jig boring, memory*, Mar. p. 90

—K—

Key slot inspection*, Dec. p. 59
Key swaging*, Dec. p. 60
Knockout device*, May p. 86

—L—

Lamination stacks
  computing, June p. 96
  assembly of*, Dec. p. 60
Lathe
  accuracy, tracer, May p. 93; June p. 87
  nosepiece*, May p. 89
  operations, Nov. p. 108
  stop*, Mar. p. 67
  tape controlled*, Dec. p. 79
Leadscrew systems, automatic threading, Sept. p. 106
Lease financing*, Dec. p. 151
Lewis Equation, Aug. p. 68
Linear accelerator*, Feb. p. 102
Locking devices, cold headed, Nov. p. 103
Lost-wax investment casting, Jan. p. 109
Lubricants*, Feb. p. 84
Lubricants, molybdenum, Apr. p. 153
Lubricating rolling contacts*, May p. 256

—M—

MMC, Feb. p. 99
Machinability, Apr. p. 89
  testing*, Aug. p. 115
Machine
  brazing, Dec. p. 62
  design, June p. 85
  gear testing, Aug. p. 68
  gun drilling, July p. 51
  indexing*, Jan. p. 88; Mar. 15, p. 56; June p. 77
  loading*, Apr. p. 61
  table accuracy*, Feb. p. 199
Machine tools
  colors*, May p. 237
  export*, Nov. p. 191
  obsolete*, Dec. p. 151
Machines (see also Specific Type)
  and manpower, scheduling, June p. 61
  coining, Apr. p. 88
  communications between*, Jan. p. 200
  gun-drilling, Feb. p. 84
Machining (see also Specific Operation)
  aluminum transmission housings, Nov. p. 96
  carbides*, Nov. p. 191
  chipless*, Sept. p. 181
  cobalt superalloys, Oct. p. 111
  differential carriers, Mar. 15, p. 68
  electrical discharge, Feb. p. 88
  electrolytic, Jan. p. 80; Feb. p. 88;* Sept. p. 181*
  electron beam*, Nov. p. 181
  errors, lathe, May p. 93
  exotic alloys, Feb. p. 88
  generator rotors*, Aug. p. 64
  graphite*, May p. 237
  hardened steel, Feb. p. 88
  hardened steels*, Nov. p. 191
  heat-resistant alloys*, Nov. p. 193
  nonconductive materials, Feb. p. 88
  optimum speed, Mar. p. 82
  plastics, June p. 99
  rates, ultrasonic, Apr. p. 74
  shafts straight, May p. 111
  spark, Feb. p. 88
  stainless steel*, Mar. p. 148
  time, Feb. p. 79
  tracer, May p. 101
  transmission cases*, Mar. p. 77
  turbine blades, Feb. p. 93
  ultrasonic, Feb. p. 88; Feb. p. 90;* Mar. p. 148; Apr. p. 71
  welded parts*, Sept. p. 181
Magnesium tooling, July p. 53
Magnetism, thermally reversed*, Feb. p. 112
Magnetostrictive transducer, Apr. p. 72
Magnets, scheduling, Aug. p. 70
Maintenance, preventive*, Apr. p. 170
Maintenance welding*, Apr. p. 170
Management
  changes facing*, Apr. p. 168
  courses, Oct. p. 76
  practice*, Mar. p. 159
  problems, Dec. p. 151
Managing engineers*, June p. 164
Mandrel, expanding*, Mar. 15, p. 44
Mandrel movement, two-dimensional*, Oct. p. 80
Manganese, effect of on tool steel, Mar. p. 96
Manufacturing
  computers for, June p. 95
  engineers, training, Nov. p. 81
  lower costs in, Jan. p. 71
  modular design for*, Nov. p. 182
  planning, Mar. 15, p. 39
  processes, June p. 86
  Revolution in, May p. 81
Manusim case study, Dec. p. 56
Materials
  cast-potting, Feb. p. 105
  extruding dies, Dec. p. 91
  handling*, May p. 253; June p. 84
  handling, cost control in, Aug. p. 42
  missile manufacture*, Dec. p. 90
Matrix, diamond wheel, Jan. p. 81
Maximum material condition, Jan. p. 84
Measurement during grinding*, Nov. p. 181
Measuring tools, new*, Apr. p. 155
Measuring without contact*, Aug. p. 115
Mechanized
  handling, Mar. p. 75
  storage, Mar. p. 75
  welding, Oct. p. 98
Meehanite, Feb. p. 96
Memory drums*, Apr. p. 70; Mar. p. 90
Metal
  cleaning*, June p. 163
  life, increasing, Apr. p. 87
  removal costs, Mar. p. 81
  reversal*, Jan. p. 76
Metal-bonded graphite, Feb. p. 203
Metalcutting
  maximum efficiency, Mar. p. 81
  phenomena, May p. 90
  plasma, Mar. p. 89
  with liquids*, Feb. p. 199
  with ultrasonics, Mar. 15, p. 57
Metallizing*, Nov. p. 112
Metallurgical Laboratory, Oct. p. 108
Metallurgy, X-ray*, Feb. p. 102
Methods, Mar. 15, p. 41
Methods engineering*, May p. 253
Milling, Mar. p. 71
  chemical, Oct. p. 93
  costs, Mar. p. 83
  cutting force, Mar. p. 73
  fixture*, Mar. p. 70
  high-strength alloys, May p. 127
  machine efficiency, Mar. p. 74
  measuring forces, Mar. p. 71
  numerically controlled, May p. 117
  power requirements*, Jan. p. 193
  turbine buckets*, June p. 152, Nov. p. 182
Mineral oils, June p. 171
Miniaturized thickness gages*, Jan. p. 116
Missile engine*, Mar. p. 89
Missile reliability*, Oct. p. 183
Missiles, Atlas*, Feb. p. 106
Mist, coolant, Aug. p. 60
Mixer screws, grinding*, Feb. p. 108
Mobot*, Feb. p. 110
Models, scale*, Apr. p. 171
Modified chuck*, Oct. p. 80
Modular design*, Nov. p. 182
Mold design, Jan. p. 116
Molding
  cycle time, Jan. p. 94
  permanent, Jan. p. 109
  shell, Jan. p. 109
Molybdenum lubricant*, Apr. p. 153
Molybdenum, effect on tool steel, Mar. p. 96
Moments, bending, Mar. 15, p. 72
Monofilament, oriented, Feb. p. 87

—N—

Nickel, effect on tool steel, Mar. p. 96
Nitrogen, Mar. p. 86
Nomograms, constructing, Feb. p. 115
Nonproductive costs, Mar. p. 81
Numerical control, Jan. p. 103; Feb. p. 113*; Apr. p. 76; Sept. p. 89; Dec. p. 85
  economic justification of*, Nov. p. 191
  in Japan, Oct. p. 99
  Russian*, Jan. p. 193
Numerically controlled
  drilling, Mar. 15, p. 65
  grinder, Nov. p. 98
  inspection, Sept. p. 96
  machines, lubrication*, Feb. p. 201
  milling, May p. 117
Nut manufacture, Dec. p. 79

—O—

Oil groove patterns, machining, May p. 117
Oils grinding, June p. 71; Aug. p. 61
Operations Research*, Sept. p. 185
Operator error, tracer lathe, Apr. p. 68
Optical tooling, Feb. p. 103; Aug. p. 51
Organization for research, Oct. p. 77

—P—

Painting, continuous spray, Mar. 15, p. 66
Palladium, Jan. p. 71
Pallet fixtures, Jan. p. 96
Paper gaging, Feb. p. 99
Parametrons, Oct. p. 99
Part interchangeability, Feb. p. 98
Part measurement gages, tracer lathe, Apr. p. 68
Parts handling systems, Mar. 15, p. 43
Patented machines, repairing*, Oct. p. 186
Patterns, shell mold, Jan. p. 112
Permanent molding, Jan. p. 109
Personnel training, Oct. p. 108
Piercing punch*, Dec. p. 58
Piercing punches, threaded*, Dec. p. 60
Piezoelectric dynamometer*, June p. 151
Pilot stripper*, Feb. p. 76
Pitch accuracy, automatic threading, Sept. p. 107
Pitch errors, June p. 88
Planner type milling machine, Aug. p. 64
Planning
  manufacturing, Mar. 15, p. 39
  problems, production, Dec. p. 55
  product*, June p. 168
  production, Feb. p. 71
Plant design, June p. 83
Plant locations, June p. 84
Plasma
  jets, Mar. p. 85
  metalcutting, Mar. p. 89
  torch design, Mar. p. 85
  welding, Mar. p. 88
Plastic
  bending, Mar. 15, p. 69
  bubble*, Dec. p. 79
  flow in metal, Nov. p. 104
  tooling, Jan. p. 91; May p. 121
Plastics
  cold formed, Nov. p. 116
  laminated, drilling, May p. 103
  machining, June p. 99
  pressure curing, May p. 121
Platen, heated, Feb. p. 94
Plating, plasma, Mar. p. 87
Pneumatic control system, May p. 100
Polycarbonate resin, Nov. p. 116
Portable tools, Oct. p. 105
Positional tolerances, Jan. p. 83; Feb. p. 98
Positioning controls, Oct. p. 100
Positioning methods*, Mar. p. 149
Powder metallurgy, Aug. p. 63
  die design, Apr. p. 83
  parts, Apr. p. 81
  press design, Apr. p. 83
  prototype tooling, Apr. p. 85
  tooling, Apr. p. 84
Powdered resin, Jan. p. 112
Power-press drives*, Oct. p. 183
Power systems, hot-forming, Feb. p. 94
Prandtl's diagram, Mar. 15, p. 69
Precision
  casting, Jan. p. 109
  fixtures, Jan. p. 96
  forgings, Jan. p. 109
Press
  feeding device, Dec. p. 87
  frames, deformation*, Aug. p. 115
  working, Oct. p. 102
  underdrive*, Mar. p. 80
Pressure pins, adjustable*, May p. 89
Preventive maintenance*, Apr. p. 170
Prick punch, spring actuated*, Sept. p. 86
Printing in automated line, Dec. p. 68
Processing, stages of, Mar. 15, p. 41
Product planning and engineering*, June p. 168
Production
  balancing*, Sept. p. 182
  drilling, Aug. p. 47
  lines, Feb. p. 71
  obtaining optimum, Mar. 15, p. 43
  planning, Feb. p. 71
  problems solved by computers, Dec. p. 55
  programmed, Feb. p. 113
Productive costs, Mar. p. 81
Professional societies*, Apr. p. 167
Professionalism*, Mar. p. 161
Profiling from templates, Dec. p. 78
Programmed production, Feb. p. 113
Programming
  automatic, Sept. p. 90
  digital*, Jan. p. 194
  for automatic diesinking, Sept. p. 99
  tape, June p. 81
Progressive forming operations, Nov. p. 102
Project
  Mercury, Sept. p. 108
  scheduling*, Sept. p. 107
  selection, research, Oct. p. 77
Properties of leaded and nonleaded steel*, Jan. p. 203
Prototype tooling, powder metallurgy, Apr. p. 85
Punch design, extruding, Dec. p. 76
Punch grinding*, Mar. p. 94
Punching dies*, Apr. p. 153
Punching hard steel*, Feb. p. 200
Punching, sheet metal, forces in*, Dec. p. 139

—Q—

Quality control, Oct. p. 93
Quality standards*, Mar. p. 158
Quenching machine, Nov. p. 100

—R—

RTV molds, May p. 122
Radial extrusion dies, Dec. p. 75
Radii grooves, machining*, June p. 64
Radiographic inspection, Nov. p. 110
Radius type extrusion dies, Dec. p. 91

*Brief article less than 1 page.

Radomes, machining, May p. 103
Rake angles, ceramic tools, Jan. p. 99
Reaming, Oct. p. 104
Recessing cutter*, Feb. p. 78
Red hardness, Mar. p. 96
Registration, engineering, Sept. p. 81
Reliability*, Mar. p. 157; Apr. p. 87
  engineering design*, Feb. p. 205
  missile*, Oct. p. 183
Relieved punch*, Jan. p. 73
Repair welding*, Apr. p. 172
Research, Oct. p. 75
  basic scientific, May p. 84
  military sponsored, May p. 85
  spending*, Dec. p. 64
  workers, Oct. p. 76
Residues from grinding, Aug. p. 59
Resin, powdered, Jan. p. 112
Resistor manufacture, Dec. p. 66
Resolver, calibrating, Nov. p. 93
Rework, cost control in, Aug. p. 42
Rivets, Dec. p. 65
Rolls, grinding, Nov. p. 98
Rotor machining, Jan. p. 105*, Aug. p. 64
Russian automation, Sept. p. 111
Russian numerical control*, Jan. p. 193

—S—

Safety program*, Oct. p. 101
Saw blades, selecting, Mar. 15, p. 75
Saw converted from horizontal boring mill, Dec. p. 80
Sawing, electrolytic, Feb. p. 93
Scale models*, Apr. p. 171
Scheduling*, Feb. p. 82
  machines and manpower, June p. 61
  tool programs with magnets, Aug. p. 70
Science in manufacturing, Apr. p. 57
Scientific methods of investigation*, Apr. p. 167
Scientist, engineer, technician triangle, Mar. p. 63
Sealing device*, Mar. p. 70
Selecting saw blades, Mar. 15, p. 75
Semiautomatic welding, Oct. p. 97
Sensing devices, Feb. p. 75
Serrations, cold formed, Nov. p. 102
Servo system, tracer lathe, Apr. p. 66
Servo transducer, Apr. p. 67
Servomechanisms, June p. 86
Setup labor, cost control in, Aug. p. 42
Shaft eccentricity, May p. 111
Shaft machining*, May p. 116
Shearing forces*, Feb. p. 200;* Nov. p. 183
Shears, cutoff*, Mar. 15, p. 46
Shell
  cores, Jan. p. 115
  molding, Jan. p. 109
  molding, tooling costs, Jan. p. 112
Shock tester, discriminating*, Aug. p. 50
Short-run production drilling, Aug. p. 47
Shrinkage, plastic molding*, June p. 169
Shrinkage, weldments*, Mar. p. 157
Simulation, computer, June p. 85
Simulation, production, Feb. p. 73
Sine plate, compound*, Dec. p. 58
Single disk check, May p. 94
Slide adjustment, tracer lathe, Apr. p. 68
Slide system, pitch and yaw, June p. 87
Slurry, abrasive, Feb. p. 88
Small hole drilling, Sept. p. 113; Dec. p. 85
Sodium nitrite, June p. 73
Solar energy, Jan. p. 71
Soluble oils, June p. 72
Space capsule, fabrication of, Sept. p. 108
Space modules, Mar. p. 75
Spark machining, Feb. p. 88
Speeds and feeds, carbides, Mar. p. 99
Speeds and feeds, ceramic tooling*, Jan. p. 193
Spindle, tracer lathe, Apr. p. 68
Stability of grinding fluids, Aug. p. 57
Stabler's Rule, Jan. p. 100
Stainless steel, forming, Feb. p. 94
Stainless steel, machining, Mar. p. 148; Dec. p. 81*
Stamping fixture*, Mar. 15, p. 45
Stampings, May p. 123; Dec. p. 87
Standardization*, Mar. p. 157
Standards, data processing*, May p. 253
Standards, quality*, Mar. p. 158
Standards, surface finish*, June p. 153
Static converter drives*, Nov. p. 193
Static testing, Oct. p. 84
Statistical cost control, Aug. p. 41
Statistical data reduction*, Apr. p. 171
Steadyrest*, Nov. p. 86
Steadyrest, lathe*, Mar. 15, p. 45
Steel
  forward extrusion of, Dec. p. 91
  hardened, machining, Feb. p. 88
  molds, cast-to-size, Jan. p. 94
  processing, Aug. p. 54
  selection, tools and dies, Mar. p. 95
  stock sizes*, Oct. p. 86
  straightening of, Mar. 15, p. 69
Steels, hardened, turning, Jan. p. 99
Steels, high-strength*, Dec. p. 152
Steels and mill shapes, new*, Oct. p. 185
Stiffening beads*, Mar. p. 69
Stock feeding device, Dec. p. 87
Stock slitter, June p. 94
Stock, storing and retrieving, Mar. p. 75
Storage, mechanized, Mar. p. 75
Storing and retrieving stock, Mar. p. 75
Straight-angle extrusion dies, Dec. p. 91
Straightening
  hand, Mar. 15, p. 73
  roller pitch, Mar. 15, p. 73
  rotational, Mar. 15, p. 73
  steel and aluminum, Mar. 15, p. 69
Stress patterns, gears, Aug. p. 67
Stretch forming*, Jan. p. 87
Stretching, forces in, Mar. 15, p. 74
Sulfochlorinated grinding oil, June p. 68
Superalloys, forming, Feb. p. 94
Surface damage from grinding, June p. 69
Surface finish*, Oct. p. 171
  cold forming, Nov. p. 105
  standards*, June p. 153
Surface plate calibration, Nov. p. 92
  layout*, Dec. p. 58
Surface preparation for chemical milling, Oct. p. 94
Surgical tool*, May p. 115
Synchronous motor, small-hole drilling, Sept. p. 113
Synthetic graphite*, May p. 237

—T—

T-bolt milling*, Feb. p. 77
Tangential cutting force, milling, Mar. p. 73
Tank shop, Feb. p. 73
Tap
  alignment fixture*, Sept. p. 85
  design, Jan. p. 117
  life, improving, Jan. p. 117
Tape control (see also Numerical Control)
  lathe*, Dec. p. 79
  programming, June p. 81
  standards, numerical*, Mar. p. 147; June p. 151
  turning, June p. 82
Tapered parts, forming, Nov. p. 105
Tapered rotor*, Oct. p. 171
Tapping
  compounds, small-hole drilling, Sept. p. 114
  cobalt superalloys, Oct. p. 111
Taylor Equation, Mar. p. 82; May p. 92
Teaching and research, Apr. p. 59
Temperature effects, tracer lathe, Apr. p. 68
Temperatures, tool face*, Jan. p. 194
Template carrier check, May p. 97
Testing
  dynamic, Oct. p. 84
  hydraulic tracers*, Nov. p. 183
  machinability*, Aug. p. 115
  static, wheel, Oct. p. 84
  ultrasonic*, Mar. p. 92
Thermodies, Jan. p. 111
Thread cutting, automatic, Sept. p. 105
Threading, Nov. p. 105
Three-dimensional contouring, Sept. p. 99
Three-dimensional drawing, Jan. p. 102
Three-roller straightening, Mar. 15, p. 72
Through machining*, Jan. p. 75
Throwaway inserts, Mar. p. 99; Apr. p. 62
Time schedules, Oct. p. 78
Titanium
  alloys, forming, Feb. p. 94
  turning*, Sept. p. 181
  welding, Sept. p. 115
Tolerances
  drilling, Feb. p. 113
  gaging, May p. 113
  inspection, Feb. p. 98
  positional, Feb. p. 98
Tongs, automatic*, June p. 82
Tool
  bits, adjustable, Oct. p. 106
  costs, Mar. p. 81
  design, diamonds, Mar. 15, p. 47
  design, ultrasonic machining, Apr. p. 73
  and die costs, Mar. p. 95
  and die life, Mar. p. 95
  engineering in Czechoslovakia*, Oct. p. 171
  face temperatures*, Jan. p. 194
  geometry, Jan. p. 99
  life, cutting, Apr. p. 89
  life, effects of workpiece diameter, Apr. p. 69
  life, extending, Apr. p. 89
  programs, scheduling, Aug. p. 70
  steel classification, Mar. p. 96
  steel, forming, Feb. p. 94
  steel, properties, Mar. p. 96
  wear*, Oct. p. 172
Tooling
  ceramic*, Mar. p. 74
  costs, shell-molding, Jan. p. 112
  with granite, Oct. p. 87
  magnesium, July p. 53
  missile*, Feb. p. 106
  optical, Feb. p. 103; Aug. p. 51
  plastic, Jan. p. 91
  powder metallurgy, Apr. p. 84
  shell-molding, Jan. p. 111
  tungsten carbide*, Nov. p. 112
Tools
  ceramic, Jan. p. 99, 193
  ceramic and carbide*, Dec. p. 139
  tracer lathe, Apr. p. 68
Tolerances, positional, Jan. p. 83
Tolerances, shell-molding, Jan. p. 113
Torch design, plasma, Mar. p. 85
Torches, plasma arc, Mar. p. 85
Torque meter, planetary gear milling, Mar. p. 72
Tracer
  control, Jan. p. 104
  controlled machines, May p. 101
  conversion system, Nov. p. 109
  lathe accuracy, Apr. p. 64; May, p. 93; June p. 87
  lathe operation, Apr. p. 64
  lathes, Nov. p. 109
  machine, May p. 101
  machining*, Dec. p. 81
Training programs, Nov. p. 82
Transducer, vibrator, June p. 93
Transducers, magnetostrictive, Feb. p. 88; Apr. p. 72
Transfer line pallets, Dec. p. 67
Transfer machine*, Mar. p. 77
Transfer machine designs, Jan. p. 96
Transfer mechanism, Nov. p. 104, Dec. p. 73
Transfer system, June p. 74
Transfer unit, gear shaver, Sept. p. 102
Transistorized grinding control*, Sept. p. 183
Transparency, grinding fluid, June p. 73
Trepanning tungsten, Feb. p. 92
Triangle, scientist, engineer, technician, Mar. p. 63
Tubing slicer, July p. 47
Tumbling device*, Apr. p. 62
Tungsten
  carbide tooling*, Nov. p. 112
  coatings, Mar. p. 88
  cold pressing, Mar. 15, p. 67
  machining, Feb. p. 92
Turbine
  blades, grinding, Feb. p. 91
  blades, machining, Feb. p. 93
  buckets, milling*, Nov. p. 182
Turning, (see also Machining; Metalcutting)
  ceramic tools, Apr. p. 69
  cobalt superalloys, Oct. p. 112
  controls, June p. 78
  eccentric*, Sept. p. 181
  hardened steel, Jan. p. 99
  operations, Jan. p. 105; p. 106; p. 108
  optimum speed, Mar. p. 84
  optimum tool life, Mar. p. 84
  noncircular shapes*, Dec. p. 141
  tape control, June p. 82
  throwaway inserts, Mar. p. 99
  titanium*, Sept. p. 181
Turret drilling, Feb. p. 113
Twin disk check, May p. 93
Twin slide feeding device, Dec. p. 88
Twist drill grinding*, Sept. p. 183
Types of extrusion dies, Dec. p. 91

—U—

Ultrasonic
  machining, Feb. p. 88; Feb. p. 90*; Mar. p. 148; Apr. p. 71; Oct. p. 88
  machining, applications of, Mar. 15, p. 57
  testing*, Mar. p. 92
Ultrasonics, Mar. 15, p. 57
Unbalance, Mar. 15, p. 51
  correction, June p. 92
  grinding wheel*, Jan. p. 194
Underdrive press*, Mar. p. 80
Underground factories, Apr. p. 79
Upsetting operations, Dec. p. 75

—V—

V-block*, Jan. p. 75
Vacuum holding devices, May p. 110
Value analysis*, Mar. p. 159
Valve-guide machining operations, Jan. p. 88
Vapor shielding, Oct. p. 97
Vector resolution, tracer lathe, Apr. p. 65
Vibration
  controlled, Jan. p. 77
  dampening*, Nov. p. 97
Vibratory tool grinding*, Dec. p. 139
Vibratory transducer, June p. 93
Vise fixture*, Feb. p. 77

—W—

WALDO, Sept. p. 99
Warpage in shafts, May p. 111
Water-base fluids, June p. 72
Water-base fluids in grinding, Aug. p. 62
Water modifiers in chemical coolants, Dec. p. 83
Wear
  grinding, June p. 68
  resistance, Mar. p. 96
  ring removal, Feb. p. 87
Welder core design, Oct. p. 90
Welding*, Feb. 206; Mar. p. 157; Nov. p. 110
  machine, May p. 98
  maintenance*, Apr. p. 170
  gear*, Mar. 15, p. 55
  plasma, Mar. p. 88
  repair*, Apr. p. 172
  semiautomatic, Oct. p. 97
  tandem arc, Mar. 15, p. 64
Weldments, Jan. p. 109
Wet-belt grinding, Feb. p. 111
Wheel balancing*, Mar. p. 147
Wheel hardness, Oct. p. 84
Wheel, silicon carbide grinding, June p. 68
Wire for cold forming, Nov. p. 102
Workers, research, Oct. p. 76
Workpiece diameter, effects on tool life, Apr p. 69
Workpiece support*, Jan. p. 76
Worksheet, scheduling, June p. 62

—X—

X-ray metallurgy*, Feb. p. 102

*Brief article less than 1 page.

1961 ALPHABETICAL INDEX OF ADVERTISERS

This index of advertisers includes all advertisers who have appeared in THE TOOL AND MANUFACTURING ENGINEER 1961, indicating the issues which carried their advertisements.

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A

*Accurate Bushing Co.—Directory
Ace Drill Bushing Co.—Jan., May, July, Sept., Dec.
Ace Drill Corp.—Feb., April, June, Aug., Oct., Dec.
*ACF Electronics—May, Oct.
Acme Industrial Co.—Jan., Feb., March, April, May, Oct., Nov.
Adamas Carbide Corp.—Feb., Directory, May, June, Sept., Nov.
Affiliated Screw Products—May
Aircraft Armaments, Inc.—April, June
*Airetool Mfg. Co., The—Feb., April, May, Aug., Oct., Dec.
Airmatic Valve, Inc.—Directory
Alina Corp., Instruments Division—Jan., Feb., March, April, May, June, July, Aug., Sept., Oct., Nov., Dec.
Alina Corp., Machine Tool Division—Jan., Feb., April, May, Oct., Nov.
*Allegheny Ludlum Steel Corp.—Jan., March, April, May, June, July, August, Sept., Oct., Dec.
*Allegheny Ludlum Steel Corp., Carmet Division—Jan., March, April, May, June, July, Aug., Sept., Oct., Nov., Dec.
Allen Company, Alva F.—March, July
Allen Mfg. Co.—Jan., Feb., May, July, Sept., Nov.
Allenair Corp.—Jan., Feb.
Allied Products Corp., Richard Brothers Punch Division—Feb., Directory, April, May
Almco Division, Queen Products, Division King-Seely Corp.—April
American Bechler Corp.—May
American Chain & Cable Co., Wilson Mechanical Instrument Division—Feb., June, Sept., Nov.
*American Drill Bushing Co.—Jan., Feb., March, Directory, April, May, June, July, Aug., Sept., Oct., Nov., Dec.
American Gage & Machine Co.—May
*American Machine & Foundry—March, April, May, July, Sept., Nov.
*American Pullmax Co., Inc.—May
*American Twist Drill Co., Subsidiary Cutting Tool Division, Brown & Sharpe Mfg. Co.—Jan., Directory, March, May, July, Sept., Nov.
Ames Co., B. C.—Feb., Directory, May, June, Aug., Oct., Dec.
Ames Precision Machine Works—May, June
Anaconda American Brass Co.—Jan., Feb., March, April, May, June, July, Sept., Oct., Nov., Dec.
Anchor Chemical Co.—Jan., March, May
*Andrews Tool & Machine, Edward—Directory
Anocut Engineering Co.—June, Nov.
Anton Machine Works—Jan., Feb., March, May, June, July, Aug., Sept., Oct., Dec.
Armstrong-Blum Mfg. Co.—Jan., Feb., March, April, May, June, July, Aug., Sept., Oct., Nov., Dec.
*Armstrong Bros. Tool Co.—Jan., Feb., March, April, May, June, Oct., Nov.
Arrowsmith Tool & Die Corp.—Directory
A R & T Electronics, Subsidiary Baldwin Piano Co.—June
Atrax Co.—Feb., March, Directory, May, June, July, Aug., Sept., Nov., Dec.
*Automatic Mill, Inc.—Jan., Feb., March, April, May, June, Oct., Nov., Dec.
Autosonics, Inc.—Jan.

B

Baird Machine Co.—Directory
Barber-Colman Co.—May, June, July, Aug., Sept., Oct., Nov., Dec.
Barnes Drill Co.—Feb., May, Nov.
Bath & Co., John—Jan., Feb., March, April, May, Sept., Oct., Dec.
Bausch Machine Tool Co.—Jan., March, May, July, Sept., Nov.
Bay State Tap & Die Co.—Feb., March, April, May, Oct., Dec.
Beatty Machine & Mfg. Co., Beatty-Quickwork Division—Feb., Oct., Nov.
Behr-Manning Co.—Feb., May, Sept., Nov.
*Bellows-Valvair—Jan., Feb., March, April, May, June, July, Aug., Sept., Oct., Nov., Dec.
*Beloit Tool Corp.—Sept.
*Bendix Corp., Industrial Controls Section—Jan., March, Directory, April, May, June, July
Bendix Corp., Kansas City Division—May
*Bentley Industrial Corp.—May
Besly-Welles Corp.—Feb., May, June
Bethlehem Steel Corp.—Jan., Directory, April, May, June, July, Sept., Oct., Nov.
Black Diamond Saw & Machine Co.—March, May, Sept.
Blanchard Machine Co., The—Feb., April, June, Aug., Oct., Dec.
Bliss Co., E. W., Press Division—June, Aug., Oct., Dec.
*Boggis Co., Henry P.—Jan.
Bokum Tool Co., Inc.—Jan., Feb., April, May, Oct.
Borg-Warner Corp., Rockford Clutch Division—Feb., April, June, Aug., Sept., Nov.
Boston Gear Works—Jan., May, July, Oct., Dec.
Boyar-Schultz Corp.—March
*Bridgeport Machines, Inc.—Feb., Directory, April, May, June, Sept., Oct., Dec.
*Bristol Co., The—Jan., March, April, May, June, Sept., Oct., Nov., Dec.
Brown & Sharpe Mfg. Co.—Jan., March, May, July, Sept., Oct., Dec.
*Brown & Sharpe Mfg. Co., Cutting Tools Division—Jan., March, Directory, May, Aug., Oct., Dec.
*Brown & Sharpe Mfg. Co., Cutting Tools Division, American Twist Drill Co., Subsidiary—March, May, July, Sept., Nov.
*Brown & Sharpe Mfg. Co., Nelco Cutting Tools Division—Feb., April, June, July, Sept.
Brush Instruments Co.—June, July, Sept., Oct., Nov.
Bryant Chucking Grinder Co.—Feb., Directory, May, June, Aug., Oct.
*Buck Tool Co.—March, May, Sept., Nov.
Bullard Co., The—Feb., March, April, Sept., Oct., Nov.
*Burgmaster Corp., Small Tool Division—May
Butterfield Division, Union Twist Drill Co.—Jan., March, Sept., Oct., Nov., Dec.

C

Cadillac Gage Co.—Jan., Directory, May, Aug., Nov.
Cadillac Stamp Co.—Jan., March
Camman Mfg. Co.—May, June, July
Capewell Mfg. Co.—March, May, July, Sept., Nov.
Card Division, S. W., Union Twist Drill Co.—Jan., March, April, June, Sept., Nov., Dec.
Carmet Division, Allegheny Ludlum Steel Corp.—Jan., March, April, May, June, July, Aug., Sept., Oct., Nov., Dec.
*Carr Lane Mfg. Co.—Jan., Feb., Directory, March, April, May, June, July, Aug., Sept., Nov.
*Cawi Machine Co., The—Jan., Feb., March, April, May, July, Aug., Nov., Dec.
*Cerro Sales Corp.—Jan., March, May, July, Sept., Nov.
*Challenge Machinery Co., The—Jan., March, Sept., Dec.
Champion Pneumatic Machinery Co.—May
*Charmilles Engineering Works, Ltd.—May
Chicago-Latrobe—Jan., March, June, Dec.
*Chromalloy Corp., Sintercast Division—Jan., March
Cincinnati Milling Machine Co.—Feb., April, June, Aug., Oct., Dec.
Cincinnati Milling Machine Co., Heald Machine Co., Subsidiary—Jan., Feb., March, April, May, June, July, Aug., Sept., Oct., Nov., Dec.
*Cincinnati Sub-Zero Products—May
Circular Tool Co.—Jan., Directory, April, June, July, Aug., Oct., Dec.
Clearing Machine Corp., Division U. S. Industries, Inc.—Feb., March, Directory, April, July, Aug., Oct., Nov., Dec.
Cleveland Cap Screw Co.—May
Cleveland Crane & Engineering Co.—Feb., April, June, Aug., Oct., Dec.
Cleveland Instrument Co., Inc.—Directory
Cleveland Tool and Die Co.—May
Cleveland Twist Drill Co.—Feb., March, April, May, Oct., Dec.
Clipper Diamond Tool Co.—May
Cogsdill Tool Products, Inc.—Directory
Columbia Research & Development Corp.—May
Columbia Tool Steel Co.—Jan., May
Columbus Die-Tool & Machine Co.—Feb., April, June, Aug.
Commando Tool Co.—Directory
Comtor Co.—Jan., March, May, June
Continental Tool Works Division, Ex-Cell-O Corp.—March, July, Aug., Sept., Oct., Nov., Dec.
Coolant Equipment Corp.—Jan.
*Cooper Weymouth, Inc.—Feb., April, June, Sept.
Coromant Division, Sandvik Steel, Inc.—Jan., March, May, Sept., Nov., Dec.
*Crafts Co., Inc., Arthur A.—Jan., March, April, May
Crane Packing Co.—Feb., April, May, June, Sept., Nov.
Cratex Mfg. Co., Inc.—May
*Crodian & Co.—May
Cross Co., The—Jan., Feb., March, May, Aug.
*Crucible Steel—Feb., Directory, May, June, Aug.
Cushman Chuck Co.—Feb., March, Directory, April, May, June, July, Aug., Sept., Oct., Nov., Dec.

D

Danly Machine Specialties, Inc.—Feb., Directory, April, June, Aug., Oct., Dec.
*Davidson Optronics, Inc.—May

Davis Division, Giddings & Lewis Machine Tool Co.—Directory, May, Aug., Sept., Oct., Nov.
Davis Keyseater Co.—Feb., June, Nov.
*Dayton Perforators, Inc.—March, April, May
Dayton Rogers Mfg. Co.—Jan., Feb., March
*Dechert Dynamics Corp.—Feb.
Delta Power Tool Division, Rockwell Mfg. Co.—Feb., April, May, June, July, Aug., Sept., Oct., Nov., Dec.
Dentists' Supply Co. of N.Y., The—March
*Detroit Stamping Co.—Jan., Feb., March, Directory, April, May, June, July, Aug., Sept., Oct., Nov., Dec.
De Van-Johnson Co.—Jan., March, May, July, Sept., Nov.
DeVlieg Machine Co., Microbore Division—May
Dexco Corp., Raymac Division—Jan., Feb., March, April, May, June, July, Aug., Sept., Oct., Nov., Dec.
*Di-Acro Corp.—Feb., April, May, Aug., Oct., Dec.
Dickerman Mfg. Co., H. E.—Jan., March, April, June, Sept., Nov.
*Diehl Mfg. Co.—March, May
Dixie Tool Industries—May, Sept., Dec.
DoALL Co.—Jan., Feb., March, May, Sept., Oct., Nov., Dec.
Dorsey Gage Co.—May
Dow Chemical Co., The—Feb., June, July, Aug., Oct., Dec.
*Dow Mechanical Corp.—Jan., Feb., March, April, May
Drillmation Co., Inc.—Directory, May
Drillunit, Inc.—Jan., July
Dugas Machine Works, Inc.—June, Sept., Dec.
*duMont Corp., The—May, Sept., Oct., Nov.
*Dumore Co., The—Jan., Directory, May, July, Sept., Oct., Dec.
Durable Punch and Die Co.—May, July
Dwight Instrument Co.—Jan., Feb., March, April, May, June, July, Aug., Sept., Oct., Nov., Dec.
Dykem Co., The—Jan., Feb., March, April, May, June, July, Aug., Sept., Oct., Nov., Dec.
Dynapak, Convair, A Division of General Dynamics Corp.—April, May, Oct.

E

Eclipse Counterbore Co.—Jan., March, May, Sept., Nov.
Edlund Machinery Co.—Sept., Oct.
Electra Products Co.—Oct., Nov., Dec.
Electroforce, Inc.—May
Eldorado Tool & Mfg. Co.—Jan., March, Directory, May, July, Sept., Nov.
Elox Corporation of Michigan—Directory
Emhart Mfg. Co.—April, May, July, Sept., Oct., Nov.
Empire Magnetics, Inc.—August
*Engelhard Hanovia, Inc., Industrial Diamond Division—Feb., April, June, Aug., Oct., Dec.
*Engelhard Hanovia, Inc., National Electric Instrument Division—Feb., April, June, Aug., Oct., Dec.
Eonic, Inc.—Jan., May, Dec.
Ercona Corp., Carl Zeiss-Jena Corp.—Jan., Feb., Directory
Erickson Tool Co.—July, Nov., Dec.
Erico Products, Inc.—Feb., Directory, May
Ernest, Holdeman & Collett, Inc., Speedgrip Chuck Division—Jan., Feb., March, April
*Ettco Tool & Machine Co., Inc.—Feb., April, Sept., Oct., Dec.
Ex-Cell-O Corp.—Jan., Feb., March, April, May, June, July, Aug., Sept., Oct., Nov., Dec.
Ex-Cell-O Corp., Continental Tool Works Division—March, July, Aug., Sept., Oct., Nov., Dec.
Ex-Cell-O Corp., Optical Gaging Products, Inc., Subsidiary—Jan., Directory, April, May, Aug., Oct., Dec.
Ex-Cell-O Corp., Omer E. Robbins Co. Division—Directory

F

Famco Machine Co.—Feb., May, June, Sept.
Fawick Airflex Division, Fawick Corp.—March, May, Sept., Nov.
Federal Products Corp.—Jan., March, Directory, May, July, Sept., Oct., Nov., Dec.
Fellows Gear Shaper Co.—Jan., Directory, April, May, July, Sept., Nov.
*Fenway Machine Co.—Directory, May
Firth Sterling, Inc.—Directory
*Flick-Reedy Corp., Miller Fluid Power Division—Jan., Directory, May, Dec.
Ford Mfg. Co., M. A.—Feb., April, June, Aug., Oct., Dec.
Fortune Industries—June, Aug., Oct.
Furane Plastics, Inc.—Jan., May, Nov.
Futurmill, Inc.—Directory, Nov.

G

*Gaertner Scientific Corp., The—Feb., April, June, Aug., Oct., Dec.
Galland-Henning Mfg. Co., Nopak Division—May, Aug., Nov.
Gardner-Denver Co.—Feb., March, Directory, May, June, Aug., Sept., Oct., Nov., Dec.
Gatco Rotary Bushing Co.—Feb., April, June, Aug., Oct., Dec.
General American Transportation Corp., Parker-Kalon Division—May, Oct.
General Dynamics Corp., Dynapak Convair, A Division—April, May, Oct.
*General Electric Co., Metallurgical Products Dept.—Feb., March, April, June, Aug., Nov., Dec.
*General Electric Co., Silicone Products Dept.—Sept.
Giddings & Lewis Machine Tool Co., Davis Division—March, May, Aug., Sept., Oct., Nov.
Gilman Co., Russell T.—Feb., May, Oct.
*Gisholt Machine Co.—Jan., Feb., April, May, June, July, Sept., Oct., Nov., Dec.
Gorton Machine Co., Geo.—March, April, May, Sept., Oct., Nov., Dec.
Gray Co., The G. A.—Jan., Directory, Sept.
Graymills, Inc.—Feb., April, June, Sept., Nov.
Greaves Machine Tool Co.—Jan.
Greenfield Tap & Die Co.—Directory, June, Oct.
*Green Instruments Co.—May
Greenlee Bros. & Co.—Jan., Feb., March, April, May, June, July, Aug., Sept., Oct., Nov., Dec.
Gridley Division, New Britain Machine Co.—Feb., March, April, May, June, Sept., Oct., Nov., Dec.
Grob, Inc.—Feb., May, July, Sept., Nov.
Grobet File Co. of America—March, May, Sept., Nov.

H

*Hamilton Watch Co.—May, Oct., Nov., Dec.
*Hammond Machinery Builders, Inc.—Feb., March, May, Nov.
Handy & Harman—Jan., Feb., March, April, May, June
Hannifin Co., Division Parker-Hannifin Corp.—Jan., Feb., March, April, June, Aug., Sept., Oct., Nov.
Hansford Mfg. Co.—Jan., May, Sept.
Hanson-Whitney Co.—Jan., April, May
Hardinge Brothers, Inc.—Jan., Feb., March, April, May, June, July, Aug., Sept., Oct., Nov., Dec.
*Harig Mfg. Corp.—Feb., March, April, May, Sept., Oct., Nov.
Hartford Special Machinery Co.—April, May, June, Sept., Oct., Nov.
Hause Machines, Inc.—May, June, Sept., Nov.
Heald Machine Co., Subsidiary, Cincinnati Milling Machine Co.—Jan., Feb., March, April, May, June, July, Aug., Sept., Oct., Nov., Dec.
*Heinrich Tools, Inc.—May
Heller Roberts Mfg. Corp.—Jan.
High Precision Products Co.—May
Hirschmann, Inc., Carl—May
Hitachi Seiki Co., Ltd.—July, Aug., Sept., Nov., Dec.
Hoggson & Pettis Mfg. Co.—Jan., March, May, July, Sept., Nov.
Holcroft & Co.—Jan., Feb., March, April, May, June, July, Aug., Sept., Oct., Dec.
*Homestrand Machine Tool Corp.—Dec.
*Houdaille Industries, Inc., Wales-Strippit, Inc.—Feb., Directory, May, July, Sept., Nov.
*Howard International, Inc., LIP Industries—May
Hudson Division, Emhart Mfg. Co.—April, May, July, Sept., Oct., Nov.
*Hughes Industrial Systems, Hughes Aircraft Co.—May
Hunt Valve Co., Bellows-Valvair—Feb., March, May, June, Aug., Oct., Dec.
*Huron Machine Products, Inc.—May, Oct., Dec.
Hutchinson Co., William T.—Nov., Dec.
Hy-Pro Tool Co.—Directory

I

Ideal Industries, Inc.—Directory, Sept., Oct., Nov.
Induction Heating Corp.—Feb., April, June, Aug., Oct., Dec.
Industrial Controls Section, Bendix Corp.—Jan., March, Directory, April, May, June, July
*Industrial Diamond Division, Engelhard Hanovia, Inc.—Feb., April, June, Aug., Oct., Dec.
Industrial Tectonics—Sept.
Ingersoll Milling Machine Co., The, Cutter Division—May, July, Sept., Nov.

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Ingersoll-Rand Co.—Directory, April, June, Sept.
International Basic Economy Corp., Bellows-Valvair—Jan., Feb., March, April, May, June, July, Aug., Sept., Oct., Nov., Dec.
Investment Casting Co.—May

J

Jacobs Mfg. Co.—April, June, Nov.
Jarvis Corp.—Jan., Feb., March, April, May, June, July, Aug., Sept., Oct., Nov., Dec.
Jersey Mfg. Co.—Aug., Sept., Oct., Nov.
Jones & Lamson Machine Co.—Jan., Feb., April, May, July, Sept., Nov.

K

Kaufman Mfg. Co.—March, July, Nov.
Kearney & Trecker Corp.—Feb., April
*Kennametal, Inc., Metalworking Division—Jan., Feb., March, May, June, July, Aug., Sept., Oct., Nov., Dec.
Keuffel & Esser Co.—Directory
King-Seely Corp., Almco, Queen Products Division—April
King Tester Corp.—Feb., April, May, Sept., Nov.
Kingsbury Machine Tool Corp.—Feb., May, June, Aug., Oct., Dec.
*Klingelhofer Machine Tool Corp., Albert—May

L

L-W Chuck Co.—Feb., March, May
Lamtex Industries, Inc.—Jan.
Lapeer Mfg. Co.—Jan., March, Directory, May, July, Sept., Nov., Dec.
Lapointe Machine Tool Co.—Feb., April, May, July, Sept., Nov.
Lapointe Machine Co.—May, Directory
Latrobe Steel Co.—Jan., Feb., May, Nov.
Lees-Bradner Co.—April, June, Aug., Oct.
Lehman Boring Tool Division, Fulton Iron Works—March, May, Sept.
Leland-Gifford Co.—Jan., March, Directory, May, July, Sept., Nov.
Lempco Industrial, Inc.—April, Aug.
Leonard Precision Products, Grind-R-Lap Division—Dec.
*Lepel High Frequency Labs.—Feb., March, June, Oct., Dec.
Lincoln Electric Co.—Feb., April
Lindberg Engineering Co.—Feb., March, April, June, July, Sept., Oct., Nov., Dec.
Linderme Engineering & Sales—Feb.
*LIP Industries, Howard International, Inc.—May
Lipe Rollaway Corp.—Jan., March, May
*Livernois Engineering Co.—June, Nov.
Loeffel Co., The Arthur—May, Oct.
*Logan Engineering Co.—Feb., Directory, April, May, June, Sept., Nov.
*Logansport Machine Co.—Jan., March, May, July, Sept., Nov.
Lovejoy Tool Co.—Feb., March, May, July, Sept., Nov.
Lucas Machine Division, New Britain Machine Co.—July, Sept., Nov.
Lucifer Furnaces, Inc.—March
*Lufkin Rule Co.—Jan., Directory, Oct., Nov., Dec.

M

M-B Products Corp.—March, April, June, Aug., Oct., Nov.
Machinery Electrification Co.—April, May, July
Macklin Company—Nov.
Madison Industries, Inc.—Feb.
*Mahr Gage Co.—Jan., April, May
*Manex Machinery Corp.—May
Manhattan Rubber Division, Raybestos-Manhattan, Inc.—Jan., Feb., Directory, May, June, Sept., Oct., Nov.
Marshall Steel Co.—April, June, Oct.
Marvel Tool & Machine Co.—Jan., Feb., March, April, May, June, July
Master Mfg. Co.—Nov.
*Master Power Corp., Subsidiary Black & Decker Corp.—Jan., Feb., March, April, May, June, July, Nov., Dec.
Mathewson Machine Works—May, June, July
Mayes Tool Co.—March
May-Fran Mfg. Co.—March, May, July, Sept.
Mayline Co., Inc.—Jan., March, May, July, Sept., Nov.
McCrosky Tool Corp.—April, May, June, Sept., Oct., Nov.
Metal Carbides Corp.—Jan.
*Metallurgical Products Dept., General Electric Co.—Feb., March, April, June, Aug., Nov., Dec.
Mettler Instrument Corp.—May
Meyers Co., W. F.—Jan., Feb., March, April, May, June, July, Aug., Sept., Oct., Nov., Dec.
Michigan Oven Co.—Feb., March, May, July, Sept., Nov.
Michigan Special Machine Co.—Feb., June, Sept.
Michigan Tool Co.—Feb., Directory, May, July, Nov.
*Micro Balancing, Inc.—April, June, Aug., Oct., Nov.
Midwest Gage Laboratory, The—May
*Miller Fluid Power Division, Flick-Reedy Corp.—Jan., Directory, May, Dec.
Milne & Co., A.—May
Mimik Tracers, Inc.—Sept., Nov.
*Minnesota Mining & Mfg. Co.—Feb., Directory, April, May
*Mohawk Tools, Inc.—Feb.
Monroe Engineering Products, Inc.—April, June, Sept., Nov.
Montgomery & Co., Inc.—April, Aug., Nov.
Moore Special Tool Co.—Jan., March, Directory, May, July, Sept., Nov.
Morse Co., H. E.—Directory
Morse Twist Drill & Machine Co., Subsidiary Van Norman Industries, Inc.—Jan., Feb., March, April, May, June, July
Morton Machine Works—Feb., April, June, Aug., Oct., Dec.

N

National Acme Co., The—Jan., Feb., March, April, May, June, July, Aug., Sept., Oct., Nov., Dec.
*National Electric Instrument Division, Engelhard Hanovia, Inc.—Feb., April, June, Aug., Oct., Dec.
National Institute of Jig & Fixtures Component Manufacturers—Directory
National Machinery Co.—March, April, May, June, Aug., Oct., Nov., Dec.
National Twist Drill & Tool Co.—Feb., April, May, June, Aug., Oct., Nov.
*Nelco Cutting Tool Division, Brown & Sharpe Mfg. Co.—Feb., April, June, July, Sept.
New Britain Machine Co., Gridley Division—Feb., March, April, May, June, Sept., Oct., Nov., Dec.
New Britain Machine Co., Lucas Machine Division—July, Sept., Nov.
Newcomer Products—May
*New Hermes Engraving Machine Corp.—May
Newton Hydraulic Tooling Co.—Dec.
New York Twist Drill Co., Inc.—May
*Nikon, Inc.—Jan., March, May, July, Sept., Nov.
Nirol Mfg. Co.—Sept., Oct., Nov.
Noble & Westbrook Mfg. Co.—May
Norgren Co., C. A.—Jan., March, May, June, July, Aug., Sept., Oct., Nov., Dec.
*Northwestern Tools, Inc.—Jan., March, April, May, July, Sept.
Norton Co., Behr-Manning Co., Division—Feb., May, Sept., Nov.
Norton Co., Machine Division—May, June, Aug., Sept., Nov.

O

*Oakite Products, Inc.—Jan., Directory, April, May, July, Sept., Oct., Nov.
*Oberg Mfg. Co.—Feb., March, April, May, June, July, Aug., Sept., Oct., Nov., Dec.
Ohio Crankshaft Co., Inc.—Feb., June, Oct.
Ohio Knife Co., The—Feb., April, May, Aug., Dec.
O K Tool Co., Inc., The—Jan., Directory, May
Optical Gaging Products, Inc., Subsidiary Ex-Cell-O Corp.—Jan., Directory, April, May, Aug., Oct., Dec.
*Opto-Metric Tools, Inc.—Feb., May, July, Sept., Nov.
*Orban Co., Inc., Kurt—May
Ortman-Miller Machine Co.—Jan., Feb., March, April, May, June, July, August, Sept., Oct., Nov., Dec.
*Osborn Mfg. Co., The—Feb., April, May, Aug., Nov.

P

Pacific Industrial Mfg. Co.—Sept., Oct., Nov.
Paddock Tool Co.—Directory
Pangborn Corp., Vibratory Finishing Division—March, April, May, June, Aug., Sept., Oct., Nov.
Parker-Hannifin Corp., Hannifin Co., Division—Jan., Feb., March, April, June, Aug., Sept., Oct., Nov.
*Parker-Kalon Corp., Division General American Transportation Corp.—May, Oct.
Perfecting Service Co.—Feb., April, May, June, Aug., Oct., Dec.
*P I C Design Corp.—Feb., March
*Pines Engineering Co., Inc.—Jan., Feb., March, April, May, June, Sept., Nov.
Pipe Machinery Co.—Feb., Directory, April, May, June, July, Aug., Oct., Dec.
Pope Machinery Corp.—Jan., Feb., March, April, May, June, July, Sept., Oct., Nov.
Porter Co., H. K.—Directory
*Porter Precision Products—June
*Pratt & Whitney Co., Inc.—Directory, April, May, Aug., Sept.
Precise Products Corp.—Jan., June, Sept.
Precision Tool & Mfg. Co.—April, May, Oct.
*Precision Welder & Flexopress Corp.—April
Preis Engraving Machine Co.—Jan., April
*Producto Machine Co., The—Feb., March, April, May, June, Oct., Dec.
*Progressive Welder & Machine Co.—May
Projecto Graph Instruments Corp.—Jan.
Punch Products Corp.—Jan., March, May, July
Putnam Tool Co.—April, June, Aug., Oct., Dec.

Q

Queen Products Division, Almco, King-Seely Corp.—April.

R

Radio Corporation of America—Directory
Raybestos-Manhattan, Inc., Manhattan Rubber Division—Jan., Feb., Directory, May, June, Sept., Oct., Nov.
Raymac Division, Dexco Corp.—Jan., Feb., March, April, May, June, July, Aug., Sept., Oct., Nov., Dec.
Ready Tool Company—Jan., Feb., March, April, May, June, July, Aug., Sept., Oct., Nov., Dec.
Reed Rolled Thread Die Co.—Jan., Feb., June, Oct.
*Ren Plastics, Inc.—Jan., Feb., Directory, May, July, Sept.
*Richards Co., J. A.—Directory
Richard Brothers Punch Division, Allied Products Corp.—Feb., Directory, April, May
Rick, Inc.—Nov.
Riggs Co., William L.—May, June, July
Ring Punch & Die, Inc.—Jan., March
Rockford Clutch Division, Borg-Warner Corp.—Feb., April, June, Aug., Sept., Nov.
Rockford Engineered Products Co.—Jan.
Rockwell Mfg. Co., Delta Power Tool Division—Feb., April, May, June, July, Aug., Sept., Oct., Nov., Dec.
Rockwell Mfg. Co., Walker-Turner Division—Jan., March, May, June, Aug., Oct., Nov., Dec.
Ross Operating Valve Co., Inc.—Directory
Roto-Finish/Ransohoff—Oct.
Rotolite Sales Corp.—Jan., May
Russell, Holbrook & Henderson, Inc.—Jan., Feb., March, April, May, June, July, Aug., Sept., Oct., Nov., Dec.
Ryerson & Son, Inc., Jos. T.—Feb., April, June, Aug., Oct., Dec.

S

S-P Manufacturing Co.—Directory, June, Nov.
Sales Service Mfg. Co.—July, Aug., Sept.
*Sandvik Steel, Inc., Coromant Division—Jan., March, May, Sept., Nov., Dec.
Schmidt, Inc., George T.—Jan., March, May, July, Sept., Nov.
*Schrader's Son, A.—Jan., March, May, July, Sept., Nov.
*Scully-Jones and Co.—Directory, May, June, July, Aug., Sept., Oct., Nov., Dec.
Sealol Corp.—March, April, May
*Sentry Co., The—May, Oct.
*Service Machine Co., Inc.—Jan., Feb., March, April, May, June, July, Aug. Sept. Oct., Nov., Dec.
Servo-Tek Products Co., Inc.—July
Severance Tool Industries, Inc.—Jan., March, May, July, Sept., Nov.
*Sheffield Corp., The—May
*Sheldon Machine Co.—Jan., Feb., March, April, May, June, July, Aug., Sept., Oct., Nov., Dec.
*Siewek Tool Co.—Directory
Sifco Metachemical, Inc.—May
*Simonds Abrasive Co.—Jan., March, May, June, Aug., Nov.
*Simonds Saw & Steel Co.—Feb., April, June, Sept., Oct., Nov.
Simpson Electric Co.—May
*Simpson Optical Mfg. Co.—Jan., March, May, Sept., Oct., Dec.
*Sintercast Division, Chromalloy Corp. — Jan., March
Size Control Co.—May
Skilcraft Corp.—April, May, June
Skinner Chuck Co., The—Jan., March, June, July
Smith & Son, Inc., James—Jan., Feb.
Snow Mfg. Co.—Jan., Directory, June
Snyder Corp.—July, Sept., Nov.
Somma Tool Co., Inc.—May
Sonnet Tool & Mfg. Co.—Nov.
Sossner Tap & Tool Corp.—June, Sept.
Special Drill & Reamer Corp.—May
Speedgrip Chuck Division, Ernest. Holdeman & Collett, Inc.—Jan., Feb., March, April
Speedline Sales Co.—Nov.
Standard Die Set Co.—Directory, April, May
Standard Electrical Tool Co.—Jan., Directory, May, June, Sept., Oct., Nov.
Standard Gage, Inc.—April, May, June, July
*Standard Pressed Steel Co.—Jan., March, May, July, Sept., Nov.
Standard Tool Co.—Feb., April, June, Aug., Oct., Nov.
*Standard Tool & Mfg. Co.—Jan., March, May, Aug., Sept., Oct., Dec.
Standard Transformer Co.—May
Star Cutter Co.—Sept., Oct., Nov., Dec.
*Starrett Co., The L. S.—Jan., March, May, Sept., Oct., Nov.
Stocker & Yale, Inc.—May, Oct., Nov., Dec.
Stone Machinery Co.—Jan., March, May, July, Sept., Dec.
Stuart Oil Co., Ltd., D. A.—Feb., March, Nov., Dec.
Sturtevant Co., P. A.—Jan., March, April, June, Aug., Oct., Dec.
*Sun Oil Co.—Feb., April, June, Aug., Oct., Dec.
Sundstrand Machine Tool Division, Sundstrand Corp.—Feb.
Sunnen Products Co.—Jan., Directory, May, Aug., Oct.
Super Tool Co., Division Van Norman Industries —Directory, May, Oct.
*Superior Die Set Corp.—Jan., Directory, May, June, Aug., Sept., Oct., Dec.
*Supreme Products Corp.—March, May, Sept.
Sutton Tool Co.—Feb., April, Oct.
Swartz Tool Products, Division of Universal Vise & Tool Co.—Sept., Oct.
*Sylvania Lighting Products—Directory

T

Taft-Peirce Mfg., The—May, June
Talcott, Inc., James—Feb., May, Sept., Nov.
Techni-Rite Electronics, Inc.—Nov.
Techno-Products Corp.—Jan., Feb., March, Aug., Sept., Oct., Nov., Dec.
Thompson Grinder Co.—Feb., April
Thompson & Son, Henry G.—Jan., April, June, Sept., Nov.
*Thompson Ramo Wooldridge—May
Thomson Industries, Inc.—Feb., April, June, Aug.
Threadwell Tap & Die Co.—Jan., Feb., March, April, May, June, Aug., Sept.
Thriftmaster Products Corp.—March, May, July, Sept., Nov.
Tietzmann Tool Corp.—Jan., Feb.
Timken Roller Bearing Co.—Feb., April, Aug., Oct., Dec.
Titan Tool Co.—Jan., March, June, Sept., Oct., Nov.
Tomkins-Johnson Co.—Jan., March, Directory, Sept., Nov.
Transmares Corp.—Sept.
Twentieth Century Mfg. Co.—Jan., Feb., March, April

U

*Uddeholm Co. of America, Inc.—March, April, May, July, Sept., Nov.
Unimet Carbides Corp.—April, May, Sept., Oct.
Union Carbide Plastics Co.—Directory, May
Union Mfg. Co.—March
Union Twist Drill Co., S. W. Card Division—Jan., March, April, June, Sept., Nov.
Union Twist Drill Co., Union Division—Jan., March, April, June, Sept., Nov.
United Greenfield Corp., Geometric-Horton Division—May, Aug.
United Greenfield Corp., Greenfield Division—Directory, June, Oct.
U. S. Drill Head Co.—Jan., March, May, Aug., Sept., Nov., Dec.
U. S. Industries, Inc., Clearing Machine Corp.—Feb., March, Directory, April, July, Aug., Oct., Nov., Dec.
Unitron Instrument Division, United Scientific Co. —April, July, Dec.
Universal-Cyclops Steel Corp.—May, Aug., Oct.
Universal Engineering Co.—Jan., March, Directory, May, Sept., Nov.
Universal Vise and Tool Co.—July, Sept.

V

Vanadium-Alloys Steel Corp.—Jan., Feb., April, May, June, Sept., Oct.
*Van Keuren Co., The—Directory, May
Van Norman Industries, Inc., Morse Twist Drill & Machine Co., Subsidiary—Jan., Feb., March, April, May, June, July
Vascoloy-Ramet Mfg. Corp.—Feb., April, May, Aug., Oct., Dec.
Verbiest Associates, Inc., C. M.—Directory
Verson AllSteel Press Co.—Jan., March, Directory, May, July, Sept., Nov.
Vibratory Finishing Division, Pangborn Corp.—March, April, May, June, Aug., Sept., Oct., Nov.
*Vidmar, Inc.—May
Viking Tool Co.—Feb., March, May, July, Sept., Nov.
*Vlier Engineering, Inc.—Jan., March, May, June, Aug., Nov.
*Vlier Engineering, Inc., Wespo Division—Feb., April, June, Aug., Oct., Dec.

W

Wadell Equipment Co., Inc.—July
Waldes Kohinoor, Inc.—May, June, Aug., Sept., Oct., Nov.
*Wales-Strippit, Inc., Houdaille Industries, Inc.—Feb., Directory, May, July, Sept., Nov.
*Walker Co., Inc., O. S.—May
Walker-Turner Division, Rockwell Mfg. Co.—Jan., March, May, June, Aug., Oct., Nov., Dec.
Wallace Supplies Mfg. Co.—March, Sept.
Walsh Press & Die Co.—May
Wardwell Mfg. Co.—Jan., Feb., March, April, May, June
Warner & Swasey Co.—Feb., March, May
Warren Electr-O-Line Corp.—Jan.
Watts Regulator Co.—May
Waukesha Cutting Tools—May
Webber Gage Co.—April
Weldon Tool Co., Inc.—Directory, May, Oct.
*Wespo Division, Vlier Engineering, Inc.—Feb., April, June, Aug., Oct., Dec.
Wesson Co.—Directory, May, June, Sept., Nov.
Wheatley Economy Die Sets Co.—Jan., Feb.
Wheel Trueing Tool Co.—May
Whistler & Sons, Inc., S. B.—Feb., April, June, Aug., Oct., Dec.
Whitman & Barnes, Inc.—Feb., Directory, April, May, Sept., Oct.
Whitmon Mfg. Co.—Jan., March, Directory, June, Aug., Sept.
Wiedemann Machine Co.—Feb., May, Oct.
Willey's Carbide Tool Co.—Directory
Wilson Mechanical Instrument Division, American Chain & Cable Co.—Feb., June, Sept., Nov.
Winslow Manufacturing Co.—Nov.
Winter Brothers Division, National Twist Drill & Tool Co.—Feb., April, May, June, Aug., Oct., Nov.
Wisconsin Drill Head Co.—May
Woodruff & Stokes, Inc.—Feb., March, April, May, June, July, Oct., Nov., Dec.
Woodson Tool Co.—May, July, Sept., Nov.
Woodworth Co., N. A.—Jan., Directory, May, June, Oct.

Y

Yoder Co., The—Jan., Feb., March, April, Dec.

Z

Zagar, Inc.—Jan., March, May, July, Sept., Oct., Dec.
Zeiss, Inc., Carl—Jan., Feb., March, Directory, April, May, June, July, Aug., Sept., Oct., Nov., Dec.
Zeiss-Jena Corp., Ercona Corp.—Jan., Feb., Directory
Ziegler Tool Co., W. M.—Jan., March, May, July, Sept., Nov.

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Index to Advertisers

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FOSDICK 168 APPLICATION AD RATING

†1961 Manufacturing Planning Issue

A

Ace Drill Bushing Co. 13
Ace Drill Corp. 127
*Airetool Mfg. Co., The 127
Alina Corp.
Instruments Div. 128
*Allegheny Ludlum
Steel Corp. 156-157, 167
Carmet Division 40
Anaconda American
Brass Co. 150
Annual Index of Advertisers . . .192
*†American Drill Bushing Co. 17
*†American Society of Tool
and Manufacturing
Engineers 158, 178, 182, 183, 184
†Ames Co., B. C. 42
Anton Machine Works 183
Armstrong-Blum Mfg. Co. 130
†Atrax Co., The 134
*Automatic Mill, Inc. 182

B

†Barber-Colman Co. 160-161
Bath & Co., Inc., John 153
Bay State Tap & Die Co. 15
*Bellows-Valvair 10, 27
Blanchard Machine Co., The . . . 20
Bliss Co., E. W.,
Press Division . . *Inside Back Cover*
Boston Gear Works 112-113
*†Bridgeport Machines 50
*Bristol Co., The 142
Brown & Sharpe Mfg.
Co. 43, 44, 45, 46, 47, 48-49
*†Brown & Sharpe Mfg. Co.,
Cutting Tools Division 155
Butterfield Division,
Union Twist Drill Co. . . .122-123

C

*Carmet Division, Allegheny
Ludlum Steel Corp. 40
*Cawi Machine Co., The 128
*Challenge Machinery Co., The . .181
Chicago-Latrobe 41
*Cincinnati Milling Machine Co. . 6
Cincinnati Milling Machine
Co., Heald Machine Co.,
Subsidiary . . . *Inside Front Cover*
Circular Tool Co. 131
*†Clearing Machine Corp.,
Division U. S.
Industries, Inc. . . . . *Back Cover*
Cleveland Crane &
Engineering Co. 180
Cleveland Twist Drill Co. 14
*Coromant Division,
Sandvik Steel, Inc. 12
†Cushman Chuck Co. 38

D

Danly Machine Specialties, Inc. . 143
Delta Power Tool Division,
Rockwell Mfg. Co. 162-163
*†Detroit Stamping Co. 110
Dexco Corp.,
Raymac Division 183
Di-Acro Corp. 147
Dixie Tool Industries 170
DoALL Co. 171
Dow Chemical Co., The 148-149
Dugas Machine Works 182
*†Dumore Co., The 22-23
Dwight Instrument Co. 183
Dykem Co., The 174

E

Electra Products Co. 183
*Engelhard Hanovia, Inc.,
Industrial Diamond Division . 24
*Engelhard Hanovia, Inc.,
National Electric
Instrument Division 177
Eonic, Inc. 172
Erickson Tool Co. 170
Ettco Tool & Machine Co., Inc. . .170
†Ex-Cell-O
Corp. 30-31, 33, 35, 37, 39

F

†Federal Products Corp. 196
*Flick-Reedy Corp.,
Miller Fluid Power Division . . 16
Ford Mfg. Co., M. A. 181

G

*Gaertner Scientific Corp., The . .114
†Gardner-Denver Co. 159
Gatco Rotary Bushing Co. 182
*General Electric Co.,
Metallurgical Products
Dept. 18-19
*Gisholt Machine Co. 2
Gorton Machine Co., George . . .166
Greenlee Bros & Co. 136
Gridley Division,
New Britain Machine Co. . .51-52

H

*Hamilton Watch Co.,
Industrial Products Division . 21
Hardinge Brothers, Inc. 9
Heald Machine Co., Subsidiary
Cincinnati Milling
Machine Co. . . *Inside Front Cover*
Hitachi Seike Machine Tools . . .176
Holcroft & Co. 114-115
Homestrand Machine
Tool Corp. 182
Hunt Valve Co.
Bellows-Valvair 10
*Huron Machine Products 172
Hutchinson Co., William T. 174

I

Induction Heating Corp. 124
*Industrial Diamond Div.,
Englehard Hanovia, Inc. 24

J

*Jarvis Corp. 126

K

*Kennametal, Inc. 26
Kingsbury Machine Tool Corp. . 173

L

†Lapeer Mfg. Co. 111
Leonard Precision Products
Grind-r-lap Division 124
*Lepel High Frequency Labs 172
Lindberg Engineering Co. 169
*†Lufkin Rule Co. 178

M

Master Power Corp., Subsidiary,
Black & Decker Mfg. Corp. . . 179
*Metallurgical Products, Dept.,
General Electric Co. 18-19
Meyers Co., W. F. 174
*†Miller Fluid Power Division,
Flick-Reedy Corp. 16
Morton Machine Works 177

N

National Acme Co., The 8
*National Electric Instrument
Division, Engelhard
Hanovia, Inc. 177
National Machinery Co. 36
New Britain Machine Co.,
Gridley Division 51-52
Newton Hydraulic Tooling Co. . .147
Norgren Co., C. A. 32

O

*Oberg Mfg. Co. 108
Ohio Knife Co. 152
Optical Gaging Products, Inc.,
Subsidiary, Ex-Cell-O Corp. . . 39
Ortman-Miller Machine Co. 149

P

Perfecting Service 115
Pipe Machinery Co. 42
*Producto Machine Co., The 144
Putnam Tool Co. 117-120

R

Raymac Division,
Dexco Corp. 183
Ready Tool Co. 182
Rockwell Mfg. Co.,
Delta Power Tool
Division 162-163
Russell, Holbrook &
Henderson, Inc. 154
Ryerson & Son, Inc., Jos. T. 54

S

*Sandvik Steel, Inc.,
Coromant Division 12
*†Scully-Jones and Co. 168, 177
Service Machine Co. 181
Sheldon Machine Co. 133
Simpson Optical Mfg. Co. 11
*Standard Tool & Mfg. Co. 141
Star Cutter Co. 28
Stocker & Yale, Inc. 172
Stone Machinery Co. 140
Stuart Oil Co., Ltd., D. A. 132
Sturtevant Co., P. A. 181
*Sun Oil Co. 25
*†Superior Die Set Corp. 198

T

Techno-Products Corp. 183
Timken Roller Bearing Co. 34

U

U. S. Drill Head Co. 4
Unitron Instrument Division,
United Scientific Co. 146

V

Vascoloy-Ramet Mfg. Corp. 106
*Vlier Engineering, Inc.,
Wespo Division 164

W

Walker-Turner Division,
Rockwell Mfg. Co. 165
*Wespo Division,
Vlier Engineering, Inc. 164
*Whistler & Sons, Inc., S. B. 174
Woodruff & Stokes, Inc. . . 158, 177

Y

Yoder Co., The 29

Z

Zagar, Inc. 174
†Zeiss, Inc., Carl 175

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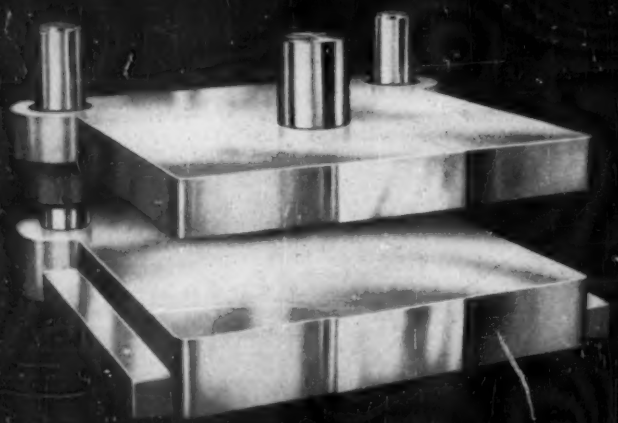

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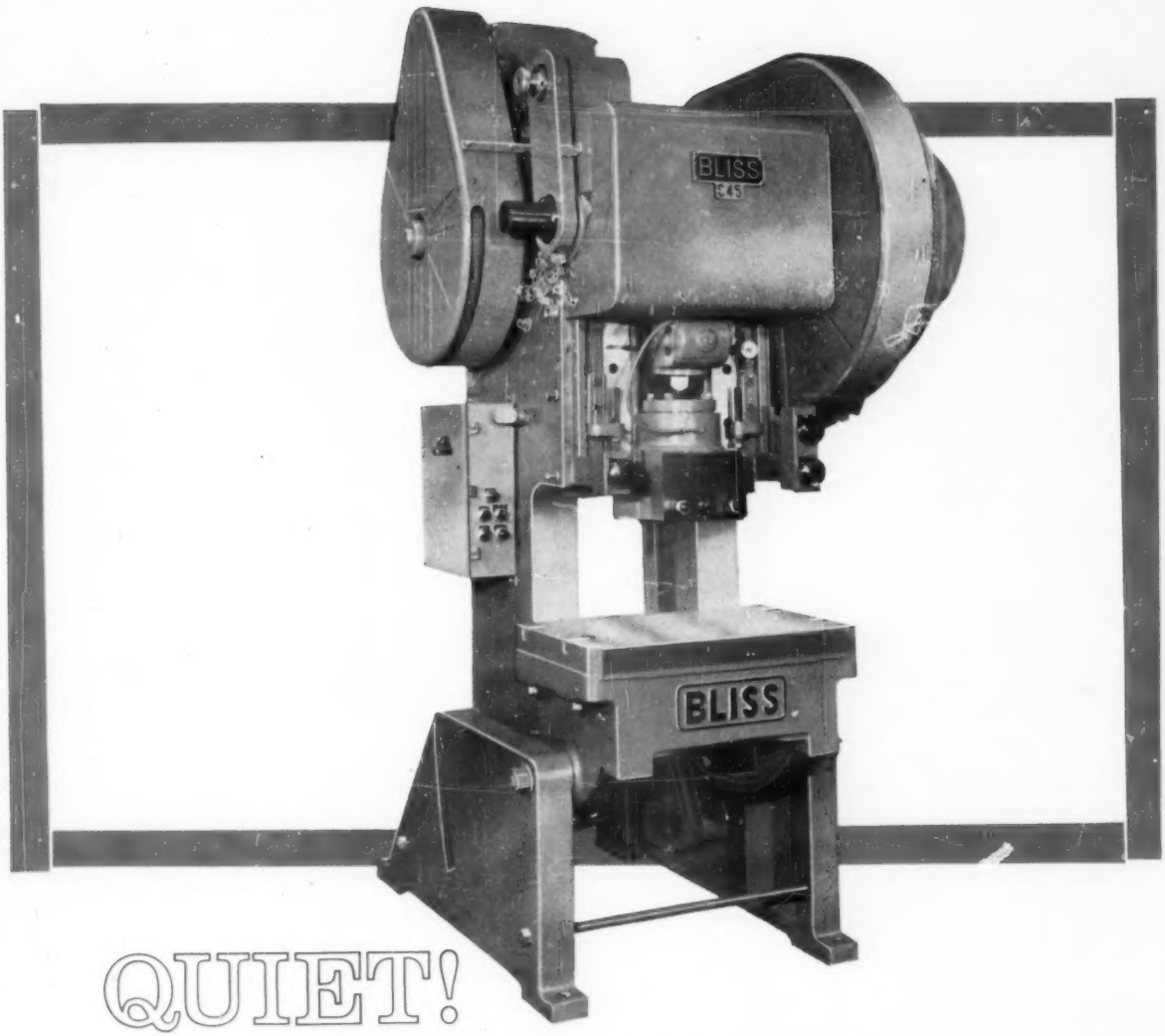

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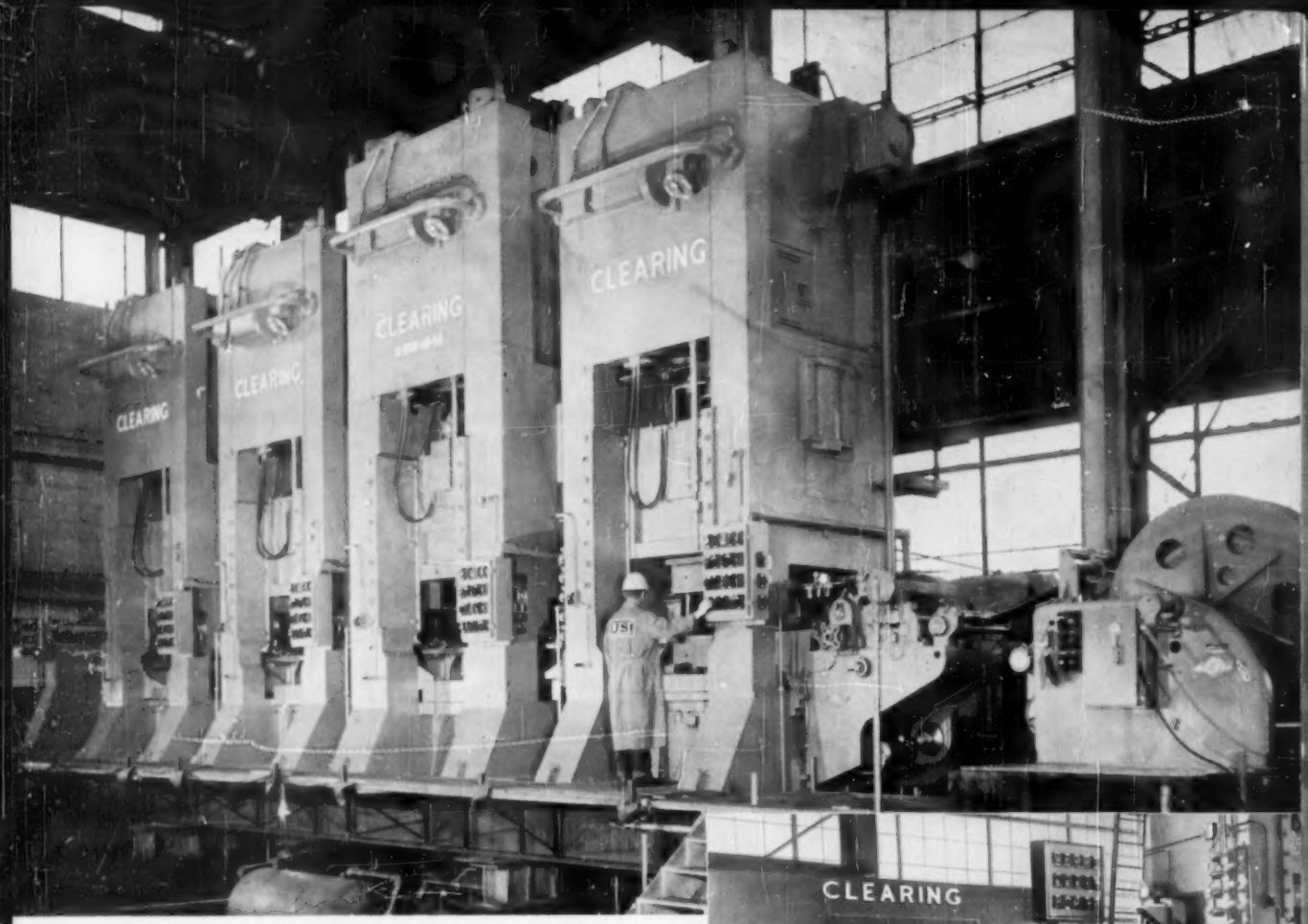

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